PLANT BREEDING ABSTRACTS

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C. A. B.
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PLANT BREEDING ABSTRACTS

4

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Plant Breeding Abstracts

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Vol. XXXI, No. 1

STATISTICS

1 Bahn, E.
Betrachtungen zum faktoriellen Versuch vom Typ 2^2. **(Considerations of a multifactorial experiment of the type 2^2).**
Z. landw. Vers.-UntersuchWes. 1959 : **5** : 232–54.

The advantages of multifactorial experiments are explained and their use is illustrated by examples. A simplified layout, with one variable in one direction and another in the perpendicular direction, thus facilitating mechanized agricultural operations, is proposed and illustrated by an example; this comprised an experiment with maize in which the effect of a N dressing was considered in one direction and that of a weed killer in the other.

GENETICS

2 Darlington, C. D.
Chromosomes and the theory of heredity.
Nature, Lond. 1960 : **187** : 892–99.

This discussion of progress made during the past 40 years in the elucidation of the role and behaviour of the chromosomes in inheritance is the substance of a lecture delivered on 20 July 1960 as part of the tercentenary celebrations of the Royal Society.

3 Crosby, J. L.
The use of the electronic computer in genetics teaching.
Heredity 1960 : **14** : p. 459.

Ways in which digital computers can be used to simulate genetic systems are outlined, the phenonema mimicked including segregation, dominance, linkage, structural heterozygosis, the Sewall Wright effect and evolution in inbreeding and outbreeding populations.

4 Shult, E. E. & Lindegren, C. C.
A survey of genetical methodology from mendelism to tetrad analysis.
Canad. J. Genet. Cyt. 1959 : **1** : 189–202.

The survey includes general considerations of: Mendelian (single particle) analysis; single-strand analysis; half-tetrad analysis; tetrad analysis; interference and preferential segregation.

5 Geršenzon, S. M.
(Idealist philosophy at the service of the leaders of Anglo-American biology).
Visn. Akad. Nauk Ukrajin. RSR (Rec. Ukrain. Acad. Sci.) 1959 : **30** : No. **5** : 51–55. [Ukrainian].

Works by S. Wright and J. Huxley are criticized for what are regarded as their bourgeois idealistic tendencies.

6 Pandey, K. K.
Mutations of the self-incompatibility gene (S) and pseudo-compatibility in angiosperms.
Lloydia 1959 : **22** : 222–34.

Pseudocompatibility may be divided into three types: (1) environmental, due to natural external and internal environmental factors, (2) artificial, brought about by mechanical, chemical and environmental treatments of the plants or flowers, and (3) genetical. The third type may be caused by (i) major or polygenic modifiers, (ii) mutated *S* alleles and (iii) inappropriate combination of *S* alleles with respect to the dominance relationships in the pollen and style. Case (iii) is possible only in a gametophytic system having two series of *S* alleles [cf. XXVIII, 2592]* or a sporophytic system. The nature of *S* mutations causing pseudocompatibility is discussed. Available information from various genera is examined in relation to (*a*) classical crossing over, (*b*) unequal crossing over, (*c*) subchromatid breakage and (*d*) complementary and independent mutations of both or only one of the two parts assumed to make up locus *S* and to control the pollen and stylar reaction respectively. It is suggested that four kinds of mutation may occur: (1) loss (deletion) mutations; "(2) non-loss mutations involving crossing-over between ♂ and ♀ parts of 2 different *S* alleles resulting in a composite allele of which the 2 parts are not complementary in reaction, e.g. $S^{2♂}_{2♀}, S^{4♂}_{4♀} \rightarrow S^{2♂}_{4♀}, S^{4♂}_{2♀}$, (3) non-loss mutations involving crossing-over which result in recombination between the male elements from 2 different *S* alleles producing a new pollen specificity; and (4) non-loss mutations of a constructive nature bringing about qualitative changes (genuine mutation)." In view of the specificity and bipartite structure of each *S* allele, it is postulated that the large number of alleles characteristic of the multiallelic type of incompatibility system evolved *de novo* rather than from mutations of one allele into another.

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* References in square brackets are to volume and number of entry in *Plant Breeding Abstracts*.

7 Esser, K.
Die Incompatibilitätsbeziehungen zwischen geographischen Rassen von *Podospora anserina* (Ces.) Rehm. III. Untersuchungen zur Genphysiologie der Barragebildung und Semi-Incompatibilität. **(Incompatibility relationships between geographical races of *P. anserina* (Ces.) Rehm. III. Investigations on the gene physiology of barrage formation and semi-incompatibility).**
Z. VererbLehre 1959 : **90** : 445–56.

The absence of melanin pigmentation characteristic of the barrage phenomenon was observed only when hyphae differing in genes t/t_1 came into direct contact; when contact was prevented by placing a membrane filter between the hyphae, no barrage phenomenon occurred. When the two races were cultured in a liquid medium and grown together, after thorough mixing in an electric mixer, the melanin failed to develop, as in the barrage phenomenon. The absence of melanin formation is ascribed to the inactivation of the polyphenoloxidase system, since the inhibitory principle loses its activity when the cells are killed. No significant difference was observed in the weight of mycelium or respiration in the mixed cultures and in separate cultures of the two races. Nor was there any difference in protein formation when the races differed only in respect of the barrage genes t/t_1; when they also differed in the semi-incompatibility genes ab/a_1b_1 there were serological differences in the proteins produced by the mixed culture. It is concluded that the anomalies of the reproductive organs result from these protein changes and are independent of the pigment inhibition caused by the barrage genes t/t_1.

8 Lederberg, J.
A view of genetics.
Science 1960 : **131** : 268–76.

This article was delivered as a lecture before the Caroline Institute, Stockholm, Sweden, on 29 May 1959. Discussing DNA chemistry, DNA in relation to bacterial mutation, genetic recombination in bacteria, analogies and differences between genes and viruses and the problem of the origin of life, the author arrives at the following conclusions concerning possible future developments. "Nucleic genes will not be readily approached for experimental manipulation except by reagents that mimic them in periodic structure. Specifically induced mutation, if ever accomplished, will then consist of an act of genetic recombination between the target DNA and the controlled information specified by the reagent. Methods for the stepwise analysis and re-assembly of nucleic acids are likely to be perfected in the near future in pace with the accessibility of nucleic acid preparations which are homogenous enough to make their use worth while. For the immediate future, it is likely that the greatest success will attend the use of biological reagents to furnish the selectivity needed to discriminate one among innumerable classes of polynucleotides. Synthetic chemistry is, however, challenged to produce model polymers that can emulate the essential features of genetic systems."

9 Case, M. E. & Giles, N. H.
Comparative complementation and genetic maps of the pan-2 locus in *Neurospora crassa.*
Proc. Nat. Acad. Sci. USA 1960 : **46** : 659–76.

Seventy-five mutations at *pan*–2, which controls conversion of keto-valine to keto-pantoic acid in pantothenic-acid synthesis, were tested in all possible pair-wise combinations for ability to complement in heterocaryons. Twenty-three gave at least one positive response, the remaining 52 failing to complement in any combination. The 23 complementing mutants were divisible into 12 different types which could be arranged in a linear sequence to form a complementation map. Agreement between the order of the mutants on this map and their order on a genetic map of the locus derived from recombination analysis was considerable, but exceptions to colinearity between the two sequences were noted. Possible interpretations of interallelic complementation and of the relationship of this phenomenon to genetic fine structure are discussed. Particular consideration is given to the characteristics of interallelic complementation in relation to the problem of defining the genetic unit of function.

10 Fincham, J. R. S. & Bond, P. A.
A further genetic variety of glutamic acid dehydrogenase in *Neurospora crassa.*
Biochem. J. 1960 : **77** : 96–105.

A new allele (am^{3a}) at locus *am* has been detected which is responsible for the production of a distinct form of glutamic dehydrogenase. Thus three alleles causing the formation of different types of this enzyme have now been identified, the other two being am^+ and am^{21}. In addition, 11 *am* alleles associated with absence of glutamic-dehydrogenase activity have been distinguished [cf. XXX, 2175]. A heterocaryon containing both am^+ and am^{3a} nuclei produced glutamic dehydrogenase, which behaved as if it were a mixture of the am^{3a} and wild-type enzymes.

11 Davis, R. H.
An enzymatic difference among pyr-3 mutants of *Neurospora crassa.*
Proc. Nat. Acad. Sci. USA 1960 : **46** : 677–82.

Preliminary enzymatic studies indicated that the metabolic block in *pyr*-3 mutants concerned the synthesis of carbamyl aspartic acid or earlier steps in pyrimidine metabolism. Several pyrimidine-requiring strains presumed to represent mutations at locus *pyr*-3, shown by Suyama *et al.* from data on complementation [cf. XXX, 2208] to consist of at least two functionally distinct regions, were therefore analysed for activity of aspartic carbamyl transferase. Five mutants had no activity, while two others contained an enzyme indistinguishable from that detected in the wild type. The results thus suggested that *pyr*-3 is a complex directly affecting production of more than one enzyme.

12 Wagner, R. P., Somers, C. E. & Bergquist, A.
Gene structure and function in *Neurospora.*
Proc. Nat. Acad. Sci. USA 1960 : **46** : 708–17.

Mutations causing requirement of isoleucine + valine belonged to linkage group V and were situated in a segment probably not more than 4 map units long. The biochemical properties and positions of the mutants upon a complementation map could be correlated.

13 Perrin, D., Jacob, F. & Monod, F.
Biosynthèse induite d'une protéine génétiquement modifiée, ne présentant pas d'affinité pour l'inducteur. **(Biosynthesis induced by a genetically modified protein, showing no affinity for the inducer).**
CR Acad. Sci., Paris 1960 : **251** : 155–57.

The enzyme β-galactosidase (Gz) may be induced in *Escherichia coli* by various galactosides, not all of them substrates for the enzyme. The structure of Gz is governed by the gene *z*, while that of a similar protein, C_{z1}, which resembles Gz in its immunological properties but which lacks enzymic activity, is controlled by the gene z^-_1. The same inducers induce synthesis of C_{z1} in z^-_1 bacteria as induce synthesis of Gz in normal bacteria. In diploid z^+/z^-_1 bacteria, the ratio C_{z1}/Gz was the same for various concentrations of the inducer isopropyl-β-d-thioglactoside, indicating that both proteins respond similarly. This shows that the inductive activity is not closely related to the activity of the induced system. Dialysis experiments indicate further that C_{z1} and C_{z4}, the synthesis of the latter being governed by another allele of *z*, do not possess an active centre or specific receptor complementary to the structure of the galactosides, i.e. that there is no specific correlation between the molecular structure of the inducer and that of the induced protein.

14 Day, P. R.
The structure of the *A* mating type locus in *Coprinus lagopus.*
Genetics 1960 : **45** : 641–50.

"(1) Crosses between monocaryotic stocks of *Coprinus lagopus* bearing markers linked with the *A* mating type locus yield a low frequency of nonparental *A* factors in tetrads and random spores. The marker arrangements in these non-parental cultures show that the new *A* factors arise as a result of crossing over between subunits of the *A* locus. Less extensive tests of the *B* locus have not revealed nonparental recombinants. (2) Seventy-nine nonparental *A* factors, isolated with the aid of linked selective markers, from crosses between A_5 and A_6 were of two types only, suggesting that only two subunits were able to recombine and give nonparental *A* factors. The original parental factor A_5 was recovered by intercrossing the two recombinant factors. The frequency of recombination between the subunits was 0·068 to 0·088 percent. (3) It is suggested that the two subunits of the *A* locus arose by duplication of a pre-existing unit. The possible structure of the subunits and the genetical basis of their specificity are briefly considered."

[Author's summary].

15 BREWBAKER, J. L. & NATARAJAN, A. T.
Centric fragments and pollen-part mutation of incompatibility alleles in *Petunia*.
Genetics 1960 : **45** : 699–704.

Self fertility in five pollen-part mutants from X-irradiated *P. inflata* is attributed to the presence in each of a small centric fragment carrying an *S* gene. As a consequence of competition interaction between *S* alleles, pollen-tube growth of fragment-bearing heterogenic pollen is not inhibited. Similar observations are reported for heterogenic diploid pollen grains of the corresponding tetraploids. The origin of centric fragments in general and the advantages of self fertility in a self-incompatible species are briefly considered.

16 SUSKIND, S. R.
Microbial genetics in the USSR.
Quart. Rev. Biol. 1960 : **35** : 41–79.

This critical review covers the period 1940–58, with emphasis on work reported during 1950–57. The material is dealt with under the following headings: mutation, adaptation and variation; chemistry of inheritance; drug resistance and antibiosis; sexual recombination; growth, cell division and cell theory; evolution and ecology; metabolism and physiology; host-parasite relationships, medical microbiology and immunology; industrial aspects and methodology; radiation biology; miscellaneous—general microbiology; and history and ideology.

17 KOHIYAMA, M. & IKEDA, Y.
Appearance of new deficient characters in streptomycin-resistant mutants of *Bacillus subtilis*.
Nature, Lond. 1960 : **187** : 168–69.

The authors have previously reported that a new deficient character, uracil dependence, appeared through a genetic interaction between two mutants of *B. subtilis* [cf. XXX, 41]. It has since been discovered, however, that uracil-dependent progeny may be recovered among colonies appearing on a streptomycin-containing medium on which cells of only one of the mutants, M12 (met, his, str–s), had been plated. In addition, some new characters, e.g. dependence on histidine or thiamin, have appeared in other streptomycin-resistant mutants. The loci for the new deficient characters and streptomycin resistance behaved independently in reversal and genetic interaction.

18 ASCHAN-ÅBERG, K.
Genetical and physiological studies on *Collybia velutipes*.
Svensk bot. Tidskr. 1960 : **54** : 329–41.

The topics covered in this review include: basidiospore germination; distribution of oidial neohaplonts; incompatibility groups; the genetical basis of fruit-body formation; neohaplont variation; and physiological studies.

19 LEWIS, D.
Non-complementarity between methionine-suppressor mutants with 20 per cent. recombination in *Coprinus*.
Heredity 1960 : **14** : 458–59. (Abst.).

"A series of recessive mutants, which suppress the requirement of *met*–1 cultures for methionine have been tested for recombination and complementarity. The mutants fall into 4–5 loci. All mutants at loci 1 and 2 are non-complementary between the mutants within each locus, but complementary between mutants from different loci and with mutants from the other 3 loci.

"Mutants grouped in the last three loci also agree in general with the rule that non-complementarity only occurs between mutants of the same or very close loci. But some exceptions were found in which the suppressor mutants that are some 20 units apart by recombination do not complement when the + alleles of the two loci are in different haploid nuclei of a dicaryon."

20 SEYFFERT, W.
Untersuchungen über die Vererbung quantitativer Charaktere an *Arabidopsis thaliana* (L.) Heynh. **[Investigations on the inheritance of quantitative characters in *A. thaliana* (L.) Heynh.].**
Z. Pflanzenz. 1960 : **42** : 336–401.

The purpose of this study was to determine whether Mather's methods of analysing quantitative inheritance were useful for studies carried out under conditions commonly met with in breeding practice. In all but a few cases the estimates obtained did not give sound information on the inheritance of the characters. The shortcomings of Mather's methods are discussed.

21 GRIGG, G. W.
Temperature-sensitive genes affecting conidiation in *Neurospora*.
J. gen. Microbiol. 1960 : **22** : 667–70.

Gene *acon*^{t} decreased the length of the aerial hyphae at 35° but not at 25°. Strains carrying *col*–1 *m* *su*^{m} and *col*–1 *m*+, normally having very short or no aerial hyphae respectively at 25°, were aconidial at 35° as the result of the action of *acon*^{t} [cf. XXIX, 1169]. The medium influenced the expression of *acon*^{t} in certain genetic backgrounds. The genotype *col*–1 *m* *acon*$^{t+}$ was microconidial at 25° but macroconidial at 35°. Since *col*–1 *m*+ strains are aconidial, *m* determined conidia production and temperature the type of conidia. Gene *su*^{m} prevents this environmental control of the conidial phenotype, *col*–1 *m su*^{m} strains being macroconidial at both temperatures; *su*^{m} may thus be described as a canalization gene.

22 Fraser, A. S.
Simulation of genetic systems by automatic digital computers. VI. Epistasis.
Aust. J. biol. Sci. 1960 : **13** : 150–62.

The next in this series of studies on computer-simulated genetic systems [cf. XXX, 4519] deals with the effect of selection against phenotypic extremes in the presence of epistatic relations. It was shown that phenotypic variability declines much more rapidly in the presence of epistasis than in its absence. The genotype-phenotype relationship, which is linear in the absence of epistasis, becomes S-shaped in its presence, resulting in the majority of *A* genotypes having the same phenotype.

23 Hayman, B. I.
The separation of epistatic from additive and dominance variation in generation means. II.
Genetica 1960 : **31** : 133–46.

The difficulties of specifying additive and dominance variation in the presence of epistasis have been pointed out previously [XXIX, 54] and are here illustrated by two examples. A further example from published data showed that when an attempt is made to partition heterosis against an arbitrary background population, the results vary according to what background population is considered. Similarly, inconsistent results are obtained when regression of heterosis is calculated over epistatic components alone. Methods of correcting these faults are described. Where epistasis is non-significant and additivity or dominance significant, the additive and dominance components are estimated together with their standard deviations by weighted least squares. When epistasis is significant but additivity or dominance significantly more important, the analysis is initially the same, but the standard deviation must be corrected upwards; a formula for doing this is suggested. In addition, epistatic components are estimated and the deviations of observation from expectation on the model ignoring epistasis are considered in terms of the epistatic components. Where epistasis is significant and at least as important as additivity and dominance, the comparison of observed and expected means seems to be the only source of information. This shows the relative importance of the three types of epistasis but cannot relate them to additivity and dominance.

24 Knapp, E.
Tetrad analyses in green plants.
Canad. J. Genet. Cyt. 1960 : **2** : 89–95.

A brief survey of tetrad analyses reported for flowering plants (*Salpiglossis*), bryophytes and algae is followed by a more detailed discussion of tetrad analysis of the liverwort *Sphaerocarpus donnellii* by the author and his colleagues. The problem of gene conversion in green plants is also discussed.

25 Fratello, B., Morpurgo, G. & Sermonti, G.
Induced somatic segregation in *Aspergillus nidulans.*
Genetics 1960 : **45** : 785–800.

From a study of the action of formalin, nitrogen mustard (HN–2) and ultraviolet rays (UV) on mitotic segregation in a heterozygous diploid of *A. nidulans*, the following points are enumerated. (1) HCHO and HN–2 produced a sharp increase in the frequency of somatic segregation; this increase is less marked in the case of UV. (2) HCHO treatment sufficient to give a survival rate of 50% produced a particularly notable increase in the frequency of subchromosomal segregates, possibly due to mitotic crossing over or terminal deletions. With increasing doses of HCHO, increasing frequencies were obtained of chromosomal (nondisjunctional) and genomic (haploid) segregates, but no further increase in the rate of subchromosomal segregates was observed. (3) The segregation patterns induced by HN–2 and UV treatment resemble that obtained at higher concentrations of HCHO; there is no indication of an increase in subchromosomal segregates.

26 Mitchell, M. B.
Ascus formation and recombinant frequencies in *Neurospora crassa.*
Genetics 1960 : **45** : 507–17.

"Observations are considered which are thought to conflict with, or to be unaccounted for by the more familiar interpretations of nuclear events in the sexual cycle of *Neurospora crassa.*

1. Preferred recombinant frequencies and, possibly, preferred ratios of certain segregation classes among asci, are found but are not predicted by interpretations which relate these frequencies directly to frequencies of crossing over. 2. Statements concerning orientation of meiotic spindles, made in support of the crossing over hypothesis designed to account for the occurrence of tetratype asci, appear unjustified by observable details. 3. Details observed in connection with the rather infrequent nuclear division figures seen in asci suggest that such figures largely represent exceptional events rather than nuclear conditions associated with successive steps in a single, regularly occurring pattern of ascospore formation. 4. The ascus itself appears to represent a complex structure formed by associations of several hyphae which cooperate in forming its spores, rather than a single, uninucleate cell which grows and divides to form spores. 5. The regular observation of pairs of adjacent asci which appear to be identical twins conflicts with the assumption that the determination of phenotype in each ascus represents an independent event. Observations concerning frequencies of aborted and partially aborted asci suggest that the phenotype of the ascus may be, in part, determined prior to its formation, in the hyphae from which it is formed." [Author's summary].

27 Richharia, R. H. & Prasad, A.
Aberrant reproduction and Mendelian anomalies.
Sci. & Cult. 1960 : **25** : 612–14.

A general consideration is given to the possible role of apomictic methods of reproduction in causing departures from Mendelian ratios of segregation in plants.

28 Kohiyama, M.
Recherches génétiques sur le *Bacillus subtilis.* (**Genetical studies on *B. subtilis***).
CR Soc. Biol., Paris 1960 : **154** : 690–92.

The occurrence of nonparental characters, including streptomycin dependence and uracil dependence, is reported for the progeny of crosses involving various mutants of *B. subtilis.*

29 Sermonti, G., Mancinelli, A. & Spada-Sermonti, I.
Heterogeneous clones ("heteroclones") in *Streptomyces coelicolor* A 3(2).
Genetics 1960 : **45** : 669–72.

Conidia collected from a mixed culture grown on a complete medium gave rise to rare heterogeneous colonies or "heteroclones" when plated on a minimal medium. On replating, a number of segregant subclones were produced. The frequency of the various segregates was close to that predicted from linkage data obtained by standard analysis, except for streptomycin-resistant segregates which were deficient in numbers.

It is thought that heteroclones may result from unstable heterozygous nuclei undergoing rapid segregation. The possible use of heteroclones in genetical analysis and in testing for allelism in *S. coelicolor* is noted.

30 Watson, M. A.
Evidence for interaction or genetic recombination between potato viruses Y and C in infected plants.
Virology 1960 : **10** : 211–32.

Potato virus Y which is aphid transmitted and potato virus C which is not aphid transmitted were jointly inoculated into *Nicotiana glutinosa* and mixed isolates transmitted by aphids from infected leaves were found to have properties of both viruses. Three other viruses resemble the isolates from mixed infection; these are PVC^{n} which originated in a glasshouse, PVC$^{\mathrm{nlab}}$ found on International Kidney potatoes in Jersey and a virus from India found in *Solanum jasminoides*. It seems possible that these viruses and the mixed isolates manifest the same basic phenomenon and although the nature of the interaction between potato viruses Y and C is unknown, it is thought most likely that particles are formed carrying genetic factors of both viruses.

31 Levine, M. & Curtiss, R.
An effect of chloramphenicol on genetic recombination and selection in phage.
Virology 1960 : **10** : 370–71.

Observations were made on phage progeny produced in *Salmonella typhimurium* 'LT2' by mutants of phage P22 in mixed infection, the infected complexes having been treated with chloramphenicol. The frequency of recombination between two *c* mutants is not affected usually by other markers in a mixed infection but in this case recombination frequencies higher than the control rate were observed when one or both parent phages carried the m_3 allele. In the untreated control cross, the frequencies for the two classes of c^+ phages, $m_3{+}{+}$ and $+{+}+$, were as expected 62% and 38% respectively, but in the chloramphenicol-treated cells the frequencies were 28% for

m_3++ and 72% for $+++$. Nonrecombinant progeny carrying m_3 were also selected against. These effects of chloramphenicol treatment were specific for the m_3 allele.

32 AJZENŠTAT, JA. S.
[A few more remarks on the "validity" of the Mendelian ratio 3 : 1 (in connexion with the article "Contrary to the obvious truth" by V. P. Ėfroimson)].
Bjull. Mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.): Otdel biol. (Biol. Ser.) 1960 : **65** : 135–42. [Russian].

The writer reasserts that in his experiments pea hybrids have given different segregation ratios from the expected Mendelian ratios and rebuts the criticisms of his work by Ėfroimson [cf. XXIX, 2167–8]. Additional evidence on aberrant segregation in the pea is provided from the hybrid Moscow x Neistoščimyj [Inexhaustible].

33 PATEMAN, J. A.
High negative interference at the *am* locus in *Neurospora crassa*.
Genetics 1960 : **45** : 839–46.

A study of the wild-type progenies from a further series of am^2 x am^3 crosses (designated am^{47} and am^{29} respectively in previous papers [cf. XXVIII, 3651]), using the markers *inos* for inositol requirement and *sp* for the morphological mutant "spray", showed that the possibility that the segment of genetic material carrying the am^2 allele might be preferentially included in the formation of *am*+ strains could be discounted, as could the theory of selective advantage of *sp* on a sorbose medium. In a total of 90 *am*+ strains, 59 possessed a parental combination of markers and 31 were recombinants. The parental types, representing double exchanges, are here more numerous than singles. A sample of 17 of the *am*+ strains were true-breeding for the *am*+ allele, 8 for the *sp* allele and 6 for the *inos* allele. It is concluded that these results are not explicable on the classical theory of crossing over, but are in reasonable accord with the switch theory of recombination.

34 CHANGEUX, J.-P.
Sur l'expression biochimique de déterminants génétiques d'*Escherichia coli* introduits chez *Salmonella typhimurium*. **(On the biochemical expression of genetical determinants of *E. coli* introduced into *S. typhimurium*).**
CR Acad. Sci., Paris 1960 : **250** : 1575–77.

Certain recombinants (ST_{hy}) of *S. typhimurium* ♀ and *E. coli* K12 ♂ were found to resemble the ♂ parent in lactose-fermenting ability while retaining all the serological, lysotypic and most of the biochemical characters of the ♀ parent. The galactoside permease and the β-galactosidase of the hybrid were similar in activity and other properties to those of *E. coli*. It is concluded that the genetic determinants of galactose utilization of ST_{hy} differ neither qualitatively nor quantitatively from those of *E. coli*.

35 SERRA, J. A.
Gene theory: a model of the gene and its sub-units.
Nucleus, Calcutta 1959 : **11** : 9–22.

In the author's view there is the necessity for a logical framework capable of integrating facts concerning the gene into a coherent theory. It is necessary to discard the idea that the gene is the ultimate genetic unit and therefore is not further divisible. The valid concept is that of the gene as an intermediary unit, standing almost midway between the chromosome and the chemically active groups which determine metabolism and thus constitute the ultimate units. Further, confusion often results from not considering the order of magnitude of different structures; the gap between the gene and chemical groups is filled by subdivisions of the gene.

Genetic properties such as crossing over demonstrate that the chromosome is clearly divisible into small segments and is not a continuous fibre-like structure. Differences in chromaticity between mitotic chromosomes and salivary chromosomes suggest that, as a rule, chromatic materials deposit, during mitosis and meiosis, on the chromonemata, which form part of the chromosomes. According to the postulated model, the chromonemata are composed of monomeres, which are linked by secondary forces. These monomeres are termed nemameres and it is suggested that there are 5–10 per gene. The mean length of each is 0·1–0·5 μ. In a segment 0·1 μ in length and 0·1 μ in diameter, about 10^4–10^5 aminoacid residues or nucleotides may exist, and many specificities are thus possible.

The minimum number of chemical groups necessary for genetic determination is referred to as a genon. It is suggested that protein genon sites and nucleic acid genon sites are effective only when they have complementary configurations. The mobile part of the genon is referred to as a cogenon and this would be the means whereby genon action in the nucleoplasm and the cytoplasm could be exerted; it would also be the only part to remain in viruses, the host proteins serving as the apogenons necessary for gene action.

The model presented here of the composite gene is employed to explain allelism, gene conversion, mutation, and nuclear determination.

36 Vezina, C.
Transport du matériel génétique chez les bactéries. (**Transport of genetic material in bacteria**).
Rev. Oka 1960 : **34** : 83–99.

Amongst the topics discussed in this review are the occurrence of mutations in bacteria, genetic recombination, sexuality, transformation and transduction. Particular attention is paid to the recent work of Lederberg and his associates.

37 Alihanjan, S. I., Il'ina, T. S. & Lomovskaja, N. D.
(**A proof of genetic transduction in *Actinomyces***).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **132** : 1179–82. [Russian].

A phage cultured in the cells of an auxotrophic strain of *Actinomyces* (*Streptomyces*) *olivaceus* was capable of promoting the development of prototrophs.

These gave rise to prototrophs, auxotrophs of the recipient and donor types and auxotrophs with nutrient deficiencies of both the donor and recipient.

The segregation of auxotrophic types with two donor nutrient deficiencies showed that two factors may be transduced at the same time.

A suspected linkage between histidine, cystine and methionine deficiencies is being investigated.

38 Doty, P., Marmur, J., Eigner, J. & Schildkraut, C.
Strand separation and specific recombination in deoxyribonucleic acids.
Science 1960 : **131** : p. 1317. (Abst.).
[Cf. XXX, 3415].

39 Lints, F. A.
Nucleo-cytoplasmic interactions in *Drosophila melanogaster*.
Genetica 1960 : **31** : 188–239.

When parents of similar age and development rate were used in crosses between *D. melanogaster* strains, reciprocal differences in reaction to temperature were found with respect to size and viability. It was shown that at each temperature the mortality of a particular nucleocytoplasmic combination, in which nucleus and cytoplasm were of the same origin, is determined by the interaction of two thermoreactive development-rate systems, one a nuclear and the other a cytoplasmic property; the former shows a constant acceleration against the inverse of the absolute temperature and the latter describes an irregular curve round the nuclear R/T function. The mortality of a hybrid is governed by the same relationship, the nuclear rate being a function of the interaction between the parental genomes and the cytoplasmic rate a function of the development speed of the maternal parent. The cytoplasmic effects observed may, however, disappear under the influence of repeated back crossing to the male parent, indicating that the cytoplasm is under nuclear control. The nuclear rate can be expressed by the formula for Arrhenius' constant, the value of which shows some relation to the degree of homozygosity. However, although this means that the nuclear function is less dependent upon temperature in hybrids than in pure strains, it does not indicate any heterotic superiority of the hybrids with regard to such fitness components as viability, development speed, size or fecundity at the temperatures studied. The bearing of the results on problems of heterosis, cytoplasmic action and quantitative inheritance is discussed.

40 Hayman, B. I.
The theory and analysis of diallel crosses. III.
Genetics 1960 : **45** : 155–72.

The theory of diallel crossing elaborated by Hayman and Jinks [XXV, 262–5, XXVII, 1011, XXVIII, 1126, and XXVIII, 3648] considered the inbred lines used in hybridization as independent. In the present paper, the analysis is extended by considering the lines as samples from an inbred but originally random-mating population. Two methods of estimation are used, involving unbiassed estimators and maximum likelihood procedures, respectively. A reanalysis of diallel-cross data with maize supplied by G. F. Sprague showed that, whereas the presence of overdominance was inferred from the earlier fixed-parent analysis, its absence was inferred from the sampled-parent analysis. A general comparison is made between the approach to the diallel cross favoured by Hayman and Jinks and those preferred by Griffing [XXVII, 1034 and 1091], and Kempthorne [XXVII, 1085].

41 Korde, V. T.
The correlations between relatives for a sex-linked character under inbreeding.
Heredity 1960 : **14** : 401–09.

Expressions are derived for the correlations between parent-offspring and full-sib pairs for a monogenically determined sex-linked character under full-sib mating. General expressions are also given for correlations between parents in the n^{th} generation and their k^{th} degree offspring, assuming no dominance.

42 Burzyński, J.
Schematyzacja metody Malécot obliczania współczynników pokrewieństwa i inbredu osobników diploidalnych. (**Simplification of Malécot's method of computing coefficients of relationship and inbreeding among diploid individuals**).
Postępy Nauk Roln. 1959 : **6** : No. **5** : 53–58.

A simplification of Malécot's system is proposed, consisting in referring coefficient R, for probability of relationship, and F, for inbreeding, only to common ancestry and to inbreeding individuals.

43 Schnack, B. & Covas, G.
Determinación de la proporción teórica de genotipos y fenotipos en poblaciones de plantas anuales de origen híbrido, con diverso grado de alogamia. (**Determination of the theoretical proportions of genotypes and phenotypes in populations of annual plants of hydrid origin, varying in degree of cross fertilization**).
Rev. argent. Agron. 1959 : **26** : 100–04.

When the effects of mutation and selective pressure are not considered, the values may be determined by formulae derived from the following expression

$$2^{a-ho}\left[\frac{c}{4^{a}}+\frac{(1-c)\,(2^{n}-1)^{ho}}{(2^{n+1})^{a}}\right].$$

This formula gives the frequency of a genotype with *ho* genes in the homozygous state in the nth generation derived from a heterozygous hybrid with a pairs of genes and a degree of allogamy c.

44 Martin, F. G.
An empirical study of the effect of linkage on progress from selection.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–4691 : 1548–49. (Abst.).

[Cf. XXX, 4519].

45 Demerec, M.
Frequency of deletions among spontaneous and induced mutations in *Salmonella.*
Proc. Nat. Acad. Sci. USA 1960 : **46** : 1075–79.

In *S. typhimurium* 'LT–2', spontaneous and ultraviolet-induced mutations affecting locus *cysC* included about 40% of deletions. No deletions were found among the 40 mutations induced by 2-aminopurine. The frequency of deletions was low among spontaneous mutations in strain LT–7, which is known to carry mutator genes causing a high rate of spontaneous mutation. The results are interpreted by assuming that the process responsible for deletions is different from that inciting single-site mutations, and that both processes may occur in spontaneous and ultraviolet-induced mutation but that 2-aminopurine and mutator genes affect only the mechanism causing single-site mutation.

46 Woodward, D. O., Partridge, C. W. H. & Giles, N. H.
Studies of adenylosuccinase in mutants and revertants of *Neurospora crassa.*
Genetics 1960 : **45** : 535–54.

Reversals were obtained from eight different adenylosuccinaseless (*ad*–4) mutants mostly derived from X-irradiated conidia. The reversals originated from untreated conidia and ones treated with X or ultraviolet rays. In all the reversals, adenylosuccinase activity was restored to at least some degree. The evidence indicated that they were true back mutations; suppressor mutations affecting locus *ad*–4 have not been found. "There appear to be a limited number of quantitative levels of enzyme activity to which a given allele is capable of being restored by reverse mutation. Evidence is presented for certain qualitative differences in the enzymes obtained from revertants of different quantitative categories, while such differences have not been detected between enzymes from revertants within a single category. Within one such category, however, qualitative differences have been found by a different criterion, namely that of relative specificity for the two natural substrates, under certain conditions. Whether or not a given *ad*–4 allele is capable of reverting to a condition equivalent to wild type in terms of its level of restored enzyme activity appears to depend on the type of damage produced by the previous mutational event or events giving rise to the allele. Four out of five primary *ad*–4 alleles yielded some reverse mutants quantitatively and qualitatively equivalent to wild type by the genetic and enzymological tests employed. Since the evidence indicates that at least some of these *ad*–4 mutants were of X-ray origin and that X-rays can produce reverse mutants indistinguishable from wild type, these results support the view that X-rays can induce complete reverse mutations of mutants originally produced by X-rays." Further investigations with one allele which failed to yield any primary reversals equivalent to the wild type indicated that secondary reversals derived after secondary forward mutation from primary reversals having subnormal activity are in some cases similarly restricted but in others surpass the primary reversals in level of restored activity.

47 DE SERRES, F. J.

Studies with purple adenine mutants in *Neurospora crassa*. IV. Lack of complementation between different *ad*-3A mutants in heterokaryons and pseudowild types.

Genetics 1960 : **45** : 555–66.

Heterocaryon and pseudowild tests on 13 *ad*–3*A* strains of independent origin provided no evidence of interallelic complementation. The recovery of true wild-type progeny from crosses of different *ad*–3*A* mutants with a marked strain of mutant *ad*–3*a*(2) suggested that region *ad*–3*A* consists of an undetermined number of mutable sites. The most probable explanation for the failure to obtain interallelic complementation is the somewhat limited number of *ad*–3*A* mutants studied. [Cf. XXIX, 90].

48 KELLENBERGER, G., ZICHICHI, M. L. & WEIGLE, J.

Mutations affecting the density of bacteriophage λ.

Nature, Lond. 1960 : **187** : 161–62.

The occurrence of mutations affecting buoyant density in caesium chloride is reported. In phage with density B2 (1·491 gm./cm.^{3}), the density was reduced compared with the wild type (1·508 gm./cm.^{3}), this decrease being accompanied by loss in ability to form stable lysogens. The allele (*b*2) responsible for this alteration in density was situated very close to *m*5. Phage with density B1 (1·512 gm./cm.^{3}) depended upon a mutation (*b*1) in region *c*, which did not affect lysogenizing frequency.

49 MIYAKE, T. & DEMEREC, M.

Proline mutants of *Salmonella typhimurium*.

Genetics 1960 : **45** : 755–62.

"By means of genetical and biochemical tests, 127 proline-requiring mutants of *S. typhimurium* were classified in four groups: 42 in *proA*, 63 in *proB*, 18 in *proC*, and four in *proD*. In the sequence of proline biosynthesis *proC* mutants are blocked between glutamic-γ-semialdehyde and proline, *proA* and *B* before glutamic-γ-semialdehyde, and *proD* mutants apparently before glutamic acid. The results of transduction tests show that the *proA*, *B*, and *C* loci are carried by the same transducing fragment; *proA* and *B* are close together and *proC* is some distance from them. Hybridization experiments with *Escherichia coli* revealed that *proA*, *proB*, *proC*, and *glt* are located close to the *lac* locus.

Eight of the mutants are due to multisite mutations, presumably deletions, of which two (*proAB*–47 and –126) cover both the *proA* and *proB* loci and extend a considerable distance toward one end of the transducing fragment. If these mutations are deletions, then the deleted region beyond *proA* and *B* either carries no genes—is genetically inert—or carries genes that produce no detectable effects." [Authors' summary].

50 MCDONALD, W. C. & WYSS, O.

Mutagenic response during sporulation of *Bacillus cereus*.

Radiation Res. 1959 : **11** : 409–17.

"Populations of *Bacillus cereus* undergoing sporulation in distilled water exhibit a period of constant sensitivity to the lethal and mutagenic effects of radiation during the first half of the process. This is followed by a sensitive period, due to some process or processes occurring during sporogenesis, and not the loss of protective material such as RNA. Subsequent to this the developing spore becomes refractory to the dose mutagenic for vegetative cells before developing heat resistance. The length of the delay in maximal expression of induced mutants was the same for mutants screened from spores of irradiated vegetative cells and mutants resulting from irradiated vegetative cells not permitted to sporulate. The effects were similar with ultraviolet and X-irradiation." [Authors' summary].

51 TSUKAMURA, M.

Relationship between the intracellular localization of beta-radioisotopes and their mutagenic effect.

Genetics 1960 : **45** : 309–14.

An experimental condition was produced under which the uptake of S^{35} by *Mycobacterium avium* was somewhat larger than the uptake of P^{32}. A more than tenfold increase in mutation frequency occurred in cells irradiated by P^{32}, whereas no significant increase was detected in those exposed to S^{35}. These results may be attributed to incorporation of P^{32} in DNA and to lack of such incorporation of S^{35}. The mutagenic effect of radioactive isotopes producing β rays is thus not always parallel with the radioactivity but may be affected by the intracellular localization of the isotope.

52 MELCHERS, G.
Haploide Blütenpflanzen als Material der Mutationszüchtung. Beispiele: Blattfarbmutanten und mutatio *wettsteinii* von *Antirrhinum majus*. **(Haploid flowering plants as material for mutation breeding. Examples: leaf colour mutants and mutatio *wettsteinii* of *A. majus*).**
Züchter 1960 : **30** : 129–34.

Vegetative haploid plants have proved useful for mutation breeding for the following reasons. (1) The success or failure of a mutagenic treatment may be quickly determined because mutations in the growing point lead to the development of chimeras. (2) Selection for resistance to unfavourable external factors or systemic diseases may be carried out directly on the treated plants and (3) mutants which cannot survive the generative haplophase or embryonic stages may be discovered in vegetative haploid plants.

53 ALIHANJAN, S. I. & ŽDANOVA, N. I.
(The comparative mutagenic effect of ethyleneimine, ultraviolet and X rays).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **133** : 454–56. [Russian].

In comparative studies of the efficacy of different mutagens upon induction of mutations in a strain of *Actinomyces* (*Streptomyces*) *olivaceus*, a producer of vitamin V_{12}, ethyleneimine proved superior to X rays or ultraviolet rays. Graphs show that this substance gave rise to a greater number of phage-resistant variants of the producer strain and also to a greater number of back mutants of histidine and cytidine-deficient strains.

54 CHATTOPADHYAY, S. B. & DICKSON, J. G.
Induced mutation and cytological investigations in *Helminthosporium oryzae*.
Phytopathology 1960 : **50** : 439–42.

Albino mutants which resembled the parental isolate in other essential features were obtained by ultraviolet irradiation of germinating conidia and young hyphae of *Cochliobolus miyabeanus* strains H_1 and H_2. The heterocaryotic condition of the mycelial cells and the reassortment of nuclei through anastomosis of cells from germ tubes of black and albino conidia were studied.

55 RAY, V. A.
Mutant induction during the divisional cycle in bacteria.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–6723 : 2500–01. (Abst.).

The mutation frequency of high-level streptomycin-resistant mutants, induced by a low dose (100 ergs/mm.²) of ultraviolet rays (UV) in a synchronously dividing culture of *Escherichia coli* B/r, was not constant throughout the divisional cycle. During division, two peaks of mutation frequency occurred, one at 10–15 min. and the other at 25–30 min. in a culture which doubled its number in about 40 min. These peaks corresponded with the period of greater sensitivity to the lethal action of UV. The first peak, which was always greater than the second, was characterized by a marked synthesis of both DNA and RNA. The second was also associated with a burst of DNA synthesis but at this time RNA synthesis had levelled off. Both peaks were due primarily to increases in the streptomycin-dependent and slow-growing streptomycin-resistant types. A third peak occurred following division and was comparable "both in time of appearance and in intensity to the first or 10 min. peak. However, a considerable number of mutants were induced when the cells were least sensitive to the mutagenic and lethal action of UV. Rapid DNA synthesis only added an additional fraction. In experiments of phosphate deprival, where growth was proceeding at a very slow rate, approximately half the number of mutants of peak periods were still induced. The periods of DNA synthesis, which occurred during at least 50 per cent of the divisional cycle, probably were conditioned by the alternation of temperature technique of obtaining synchronous cultures. RNA synthesis in such cultures was most intensive during the 10 min. period following cell division and then proceeded at an extremely slow pace." The findings that (1) supplementation with a mixture of ribonucleosides and aminoacids prior to irradiation caused a marked increase in mutation frequency and (2) supplementation with 6-azauracil caused a marked decrease in mutation frequency during the early part of the divisional cycle "tended to implicate RNA in the mutagenic processes."

56 BROCKAJA, S. Z.
(The effect of various doses of ultraviolet radiation on the production of *Aspergillus nidulans* variants with active proteases).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 358–62. [Russian].

Investigations were made on 218 strains of *A. nidulans* 'BIN 252' produced by ultraviolet irradiation; with increasing dose the proteolytic activity increased, up to an optimum for wavelength 2537 Å at 48 x 10^{-3} erg/conidium for 3 mins. 20 sec., and then fell. Only 22 variants showed increased proteolytic activity, all but one of them being different also in morphological features. Further irradiation of the initial strain with the optimum dosage gave rise to 57 more variants, 6 of which had increased proteolytic activity. The variants lost their increased activity after 4 months of culture and further irradiation combined with selection is thought to be necessary for the production of genetically stable mutants.

57 PIROVANO, A.
Genetica difficile. **(Difficult genetics).**
Frutticoltura, Bologna 1960 : **22** : 231–33.

In referring to an address he delivered to the Academy of Agricultural Sciences in Moscow, the author emphasizes the heterozygous nature of most fruit trees, both cultivated and wild, which he considers sufficient to account for the discrepancies between the results of Mičurin and those of Mendel.

58 GORSHKOV, I. [GORŠKOV, I. S.]
I. V. Michurin's scientific heritage.
Allahabad Fmr. 1960 : **34** : 62–66.

A popular account for readers in India is given of the application of Mičurin's principles and methods to the breeding of various crops in the USSR.

EVOLUTION

59 CLAUSEN, J.
The function and evolution of ecotypes, ecospecies, and other natural entities.
Uppsala Univ. Årsskr. 1958 : **6** : 139–43.

From studies by the author and others [cf. XXII, p. 627], some conclusions regarding the role of genetics, physiology and environment in the evolution of species are presented.

60 LACK, D.
The conflict between evolutionary theory and Christian belief.
Nature, Lond. 1960 : **187** : 98–100.

The author shows how the conflict between the acceptance of Darwinism and religious belief is still not settled a hundred years after its origin.

61 POLJAKOV, I. M.
(Botanical studies of Lamarck and his evolutionary theory).
Ukrajin. bot. Ž. (Ukrain. J. Bot.) 1959 : **16** : No. 6 : 3–14. [Ukrainian].

The influence of Lamarck's taxonomic and phylogenetic studies of plants and his observations on variability in plant species upon his concept of evolution are discussed.

62 SCHNACK, B.
Darwin y los conceptos modernos sobre evolución. **(Darwin and modern concepts of evolution).**
Bol. Soc. argent. Bot. 1959 : **7** : 167–79.

The historical background of Darwin's work on evolution is outlined and developments since then are reviewed, with special emphasis on the views of Simpson and Schmalhausen.

63 NANNEY, D. L.
Microbiology, developmental genetics and evolution.
Amer. Nat. 1960 : **94** : 167–79.

In this general essay it is shown that there are many essential similarities in the developmental processes of unicellular and higher organisms.

64 DVORJANKIN, F. A.
[A great naturalist. (On the occasion of the centenary of the publication of Ch. Darwin's major work "The origin of species")].
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 55–58. [Russian].

Darwin is praised for recognizing the effects of external conditions upon variability, selection, evolution and heredity. In Russia, Mičurin and others have gone further by altering plant organisms through environment. Some Mičurinist achievements in plant breeding are briefly surveyed.

65 MILLICENT, E. & THODAY, J. M.
Gene flow and divergence under disruptive selection.
Science 1960 : **131** : 1311–12.

"Two halves of a population [of *Drosphila* *melanogaster*] exposed to selection in opposing directions can diverge despite gene flow of the same amount as is given by random mating. Divergence was as great as it is with complete isolation. Isolation, therefore, is not a prerequisite of divergence under divergent selection pressures." [Authors' summary].

66 Needham, A. E.
The origination of life.
Quart. Rev. Biol. 1959 : **34** : 189–209.

A theoretical study is made of the conditions requisite for the spontaneous origin of life assuming only probable events. It is concluded that (1) current hypotheses err in treating primeval organisms as static instead of dynamic metabolizing entities, (2) material rather than energy has been the limiting factor in evolution, and (3) the making good of losses by wear and tear is one of the most essential requisites for the continuance of life.

67 Fox, S. W.
How did life begin?
Science 1960 : **132** : 200–08.

It is reported that polymers containing up to 18 aminoacids have been obtained by dry heat (150–200° C.). These have many of the properties of natural proteins but show no stereoisomeric specificity nor antigenicity. Possible ways in which life may have arisen are considered and the possibility that spontaneous generation is still occurring is emphasized.

68 Simonet, M.
La création d'espèces nouvelles. **(The creation of new species).**
Cah. Étud. biol. 1958 : No. 5 : 74–88.

This general review deals with the natural and artificial evolution of new species. Several well-documented examples are given; particular attention is paid to the role of different types of polyploidy.

CYTOLOGY

The relationship between nucleus and cytoplasm. Proceedings of the symposium held June 9-13, 1958 at l'Université Libre de Bruxelles, Belgium.
Exp. Cell Res. 1959 : Suppl. 6 : Pp. 276.

69 *Bernhard, W. Ultrastructural aspects of nucleocytoplasmic relationship. (pp. 17–50).*

With reference to recent investigations using the electron microscope, the principal organelles involved in nucleic acid and protein synthesis and in the nucleocytoplasmic exchange of substances are described.

70 *Jacob, F. Transfer and expression of genetic information in* Escherichia coli *K12. (pp. 51–68).*

"1. In *E. coli* K12, conjugation between H fr donors and F⁻ recipients involves the oriented transfer, under a rather precise time schedule, of chromosomal segments from the donors to the recipients.

"2. The order and the distances between characters located on the H fr chromosome may be determined in genetic units, in time units, and in number of phosphorus atoms.

"3. This system is useful for the study of gene function upon transfer of genetic material from the donor to the recipient. The time required for phenotypic expression depends upon the nature of the character under investigation.

"4. Synthesis of the enzyme β-galactosidase starts in the zygotes a few minutes after the arrival of the genetic determinant into the recipient cells at a rate close to the expected maximum and independently of any genetic integration.

"5. Inducibility of β-galactosidase synthesis is dominant over constitutivity. Inducibility appears therefore to result merely from the repression of enzyme synthesis, this repression being suppressed by the addition of external inducer." [Author's summary].

71 *Chayen, J. The quantitative cytochemistry of DNA and its significance in cell physiology and heredity. (pp. 115–31).*

The hypothesis that DNA is the primary component of the gene is based on the following findings: (1) DNA occurs only on the chromosomes; (2) it is constant in amount per chromatid and (3) it can carry genetic information as shown by studies with bacteria. The data are now examined critically and results contrary to (1) and (2) are mentioned. It is suggested "that all the data could be reconciled if most of the DNA were not the nuclear gene but the agent by which this gene sends its message to self-duplicating cytoplasmic particles".

72 *Michaelis, P. The genetical interaction between nucleus and cytoplasm in* Epilobium. *(pp. 236–51).*

"Through a systematic search with large collections of *Epilobium* species, strains, and mutants, a number of different nuclei and different cytoplasms has been found, the combination of which demonstrates that reciprocal differences by cytoplasmic inheritance are not caused by cytoplasm alone but by a disturbed balance between nucleus and cytoplasm. A change of gene dominance and gene manifestation under the influence of a foreign cytoplasm could be demonstrated, furthermore mutual influences on the stability and mutability of the different genetic units. The influence of nuclear genes and of intercellular correlations on the intra-individual segregation of cytoplasmic particles may play an important part in determination and differentiation. The different genetic units of the cell form a genetically-determined reaction system, each member of which independently propagates its specific properties by identical reproduction, but which react with one another and influence one another."

[Author's summary].

73 *Danielli, J. F. Some theoretical aspects of nucleocytoplasmic relationships. (pp. 252–67).*

The extent to which cellular characters are controlled by the nucleus, the cytoplasm or both and possible mechanisms of control are considered.

74 *Emera, M., Ficq, A., Logan, R., Skreb, Y. & Vanderhaeghe, F. Nucleocytoplasmic relationships in irradiated cells. (pp. 268–76).*

The effects of X and ultraviolet irradiation on isolated nuclei of thymus and liver and on nucleated and nonnucleated halves of *Amoeba* and *Acetabularia* are discussed. The cytoplasm does not seem to be essentially more resistant to radiation than the nucleus but many biological processes depend on nuclear mechanisms sensitive to radiation. Whereas the nucleus has some control over many cytoplasmic processes, including recovery from radiation damage, there is little evidence of the reverse effect.

75 PERDUE, R. E. (JUN.).
A rapid Feulgen-acetocarmine squash technique for root tip chromosomes.
Wrightia 1960 : **2** : 86–89.

A staining technique combining the Feulgen and acetocarmine methods is described.

76 ZALOKAR, M.
Sites of protein and ribonucleic acid synthesis in the cell.
Exp. Cell Res. 1960 : **19** : 559–76.

The localization of newly formed proteins and RNA in *Neurospora* hyphae was studied by means of centrifugation and autoradiography techniques. The results indicated that most cell proteins are made in the ergastoplasm but some are synthesized in nuclei and mitochondria; at least 99% of the cellular RNA is made in nuclei whence it migrates into the cytoplasm. Gene action is discussed in relation to these results which support the hypothesis that RNA carries genetic information from the nucleus into the cytoplasm where proteins are made.

77 MORRISON, J. H., LEAK, L. V. & WILSON, G. B.
Combined staining of nucleolus and chromosomes in squash preparations of plant and animal somatic tissues.
Trans. Amer. micr. Soc. 1959 : **78** : 358–62.

After fixation with Rattenbury's mixture or a modification of it, followed by acid hydrolysis, differential staining is achieved by the use of Schiff's reagent, which stains the chromosomes, and acetocarmine and fast green, both of which are taken up strongly by the nucleolus and spindle fibres.

78 KOOPMANS, A.
De ontwikkeling van het chromosomen-chemisch onderzoek. **(The development of research on chromosome chemistry).**
Vakbl. Biol. 1960 : **40** : 38–56.

In this historical survey, the topics referred to include the localization of nucleic acids in the nucleus, transformation in bacteria and higher organisms, transduction, the role of DNA in chromosome reduplication, the structure of DNA and the relation between the nucleic acids and protein synthesis.

79 CHATTERJEE, S. N. & SADHUKHAN, P.
Direct visualization of the dissociation of the twin-stranded DNA molecules.
Naturwissenschaften 1960 : **47** : 131–32.

In electron photomicrographs of fresh DNA numerous parallel particles intercrossing in some places and measuring about 25 Å. in width may be seen, while in those of DNA aged for over two months at about 27° C. in a buffer at pH 8·8 (1) the long filaments have assumed a beaded structure, (2) the sugar-phosphate chains in twin-stranded molecules appear to become separated from one another, (3) the finer chains have split into small fragments, and (4) fragmented particles lie throughout the field, well separated but in linear array. These effects may result from the fragmentation of the duplex chain of the intact molecule. Ultraviolet absorption studies reveal an increase of 6256 to 7430 in the atomic extinction coefficient of DNA with respect to phosphorus (Ep) at 260 mμ, due to aging in buffer. The ratio of the extinction coefficient of the aged DNA to that of the fresh is found to be the same in the wavelength region 235–280 mμ, indicating an irreversible change in molecular structure.

80 RICH, A.
A hybrid helix containing both deoxyribose and ribose polynucleotides and its relation to the transfer of information between the nucleic acids.
Proc. nat. Acad. Sci. USA 1960 : **46** : 1044–53.

A hybrid helix with the strands held together by hydrogen bonds has been prepared between synthetic polydeoxyribothymidic acid and polyriboadenylic acid. The existence of such a complex suggests a possible mechanism for transfer of information from DNA to cellular RNA.

81 ATWOOD, K. C.
Sequential deoxyribonucleic acid replication.
Science 1960 : **132** : 617–18.

Reasons for supposing that replication of the Watson-Crick structure for DNA would be sequential or semisequential rather than simultaneous are presented. The sequential models predict that up to one-third of the DNA is in the single-standed form at some time in the replication cycle.

82 KORNBERG, A.
Biologic synthesis of deoxyribonucleic acid.
Science 1960 : **131** : 1503–08.

DNA characteristic of various plant and animal tissues has been synthesized in the presence of the DNA sample which it was desired to copy, the 5′-triphosphates of the deoxynucleotides of adenine, thymine, guanine and cytosine and a DNA-synthesizing enzyme obtainable from *Escherichia coli*. The primer DNA can be heated and it appears that double-stranded DNA is inert unless heated or slightly pretreated with DNase.

83 ASCHAN-ÅBERG, K.
Studies on dedicaryotization mycelia and of F_1 variation in *Collybia velutipes*.
Svensk bot. Tidskr. 1960 : **54** : 311–28.

Neohaplonts [cf. XXIII, 1762] obtained from dicaryotic mycelia by microsurgical methods or by plating out of oidia included a number of deviating types in addition to the original monocaryotic types used in synthesizing the dicaryotic combinations. From a number of dicaryotic combinations between normal and "degenerate" types, rather variable F_1 progenies were obtained. The intercompatibility of the F_1 mycelia was usually depressed, but in a few cases matings of an unexpected type occurred, possibly through the production of new incompatibility factors by crossing over within a compound locus.

84 BAL, A. K. & KAUFMANN, B. P.
Action of deoxyribonuclease on chromosomes of microsporocytes.
Nucleus, Calcutta 1959 : **11** : 51–62.

An analysis of the effects of deoxyribonuclease on meiotic chromosomes of *Tradescantia* microsporocytes is reported. Degradation of chromosomal materials commenced rapidly after exposing the cells to the enzyme. Visible deformation of the chromosome occurred even while DNA still remained in the cell contents, the index of DNA presence being Feulgen stainability.

Removal of RNA from the chromosome prior to treatment with deoxyribonuclease inhibited the deformation of the chromosomes, but not the degradation of DNA. These findings suggest that the chromosomal deformation caused by deoxyribonuclease is not directly referable to the degradation of DNA but to an alteration of the entire nucleoprotein complex. It is thus apparent that DNA alone cannot be responsible for the maintenance of the structural integrity of these meiotic chromosomes. Other observations made during the experiment suggest that DNA may play an important part in determining the coiling pattern of chromosomes.

85 MONTEZUMA-DE-CARVALHO, J. & CRAWLEY, J. C. W.
The fixation of chromosomes for electron microscopy.
Exp. Cell Res. 1960 : **20** : 211–13.

Half anthers of *Tradescantia bracteata* at second-division metaphase and anaphase were fixed for 1 hr. in 1% osmium tetroxide buffered at pH 4 or 7·6 with veronal acetate and in 45% acetic acid; the material was embedded in methacrylate. The appearance of the chromosomes differed greatly in material fixed by the two substances; with acetic-acid fixation the chromosomes appeared less "electron dense" and seemed to consist of clumped microfibrils surrounded by a dense layer; this may be an artifact, for chromatids frequently appeared to be stuck together and the outer layer often enclosed more than one chromatid. Coiling of mitotic chromosomes was not observed. It is pointed out that a phospholipid is thought to become associated with chromosomes from mid-prophase to the end of anaphase and 45% acetic acid is a good solvent for lipids; osmium tetroxide however is a stain for lipids so the phospholipid may mask the fine structure of the chromosomes. These results indicate that more work on chromosome fixation is required before the ultrastructure may be understood.

86 GUTTMAN, R. & BROWN, S. W.
The influence of indole acetic acid and kinetin on radiation damage to dividing root meristems.
Nucleus, Calcutta 1959 : **2** : 111–18.

In *Allium cepa* root tips, kinetin did not influence the rate of recovery from mitotic inhibition caused by previous X irradiation at 70 r. Indole-3-acetic acid (IAA) restored to pre-irradiation levels the mitotic frequencies in cells irradiated at or just before prophase. A joint application of the two substances, however, produced complete recovery regardless of the time of irradiation. With regard to the rejoining of chromosome breaks, kinetin had a stimulatory effect on cells irradiated close to mitosis, but IAA alone was ineffective. IAA and kinetin together were again most effective; they significantly lowered the proportion of aberrant anaphases and telophases regardless of whether irradiation took place during interphase or premitosis. It is suggested that both IAA and kinetin-like substances are necessary for the initiation of mitosis and that the radiation sensitivity of each substance varies according to the stage in the cell cycle at the time of irradiation. The influence of hormonal balance on recovery from radiation damage is discussed in relation to oxidative metabolism, the coiling of chromosomes, and chelation and complex formation within the nucleus.

87 LETTRÉ, H. & LETTRÉ, R.
A cytological problem : permanence of the chromosomal spindle fiber during interphase.
Nucleus, Calcutta 1959 : **11** : 23–44.

The hypothesis that the chromosomal spindle fibre represents a permanent self-reproducing structure is discussed. Certain problems in mitosis and meiosis, including several imperfectly understood phases, are described in the light of this hypothesis. The new approach to the relationship between centromere, spindle fibre and centriole, as well as other chromosomal structures, will, it is held, be valuable for the understanding of the genesis of different kinds of polyploid cells, and of the aneuploidy found in tumour cells.

88 SHARMA, A. K. & CHATTERJI, A. K.
Effect of asparagine on plant nuclei.
Caryologia 1960 : **12** : 404–13.

In experiments on onion root tips, treatment with 0·005% asparagine solution for 120 hr. induced division of polyploid cells in the differentiated tissue. No other concentration, even when applied for different periods, had this effect. Somatic reduction in the meristematic cells was observed with some treatments. It is suggested that these two effects were brought about by change in the nucleoprotein balance. C-mitotic effects were also noted.

89 RODRIGUES PEREIRA, A. S.
De biologische betekenis van kinetine. (**The biological significance of kinetin**).
Vakbl. Biol. 1960 : **40** : 105–18.

The topics discussed in this review include the role of kinetin in promoting mitotic cell division and increasing the rate of meiosis and the chemical basis of its action.

90 DAS, N. K. & ALFERT, M.
Effects of X-rays on proliferation, DNA and histone synthesis in onion root tip cells.
J. Histochem. Cytochem. 1960 : **8** : 329–30. (Abst.).

In contrast to its inhibitory effect on mitosis, X irradiation did not interfere with DNA and histone synthesis.

91 TRUHAUT, R. & DEYSSON, G.
Étude, sur les cellules méristématiques végétales, des caractéristiques de l'activité antimitotique d'un composé antipyrimidique. (**A study on plant cells of the characteristics of the antimitotic activity of an antipyrimidine compound**).
CR Acad. Sci., Paris 1960 : **251** : 593–95.

The hydrochloride of 2-chloro-2-benzylthio-4-dimethylamino-5-methyl pyrimidine (DG428) is lethal to root tips of *Allium sativum* at concentrations of 5×10^{-7} M. After 3 hr. at 1·5–2 $\times 10^{-7}$ M. a mitoclastic effect is observed but after 24 hr. mitosis is again normal. A concentration of 10^{-7} M. has a very slight mitoclastic effect and lower concentrations do not affect mitosis.

92 DEYSSON, G. & TRUHAUT, R.
Étude des propriétés antimitotiques de la carzinophiline sur les cellules méristématiques d'*Allium sativum* L. **(Study of the antimitotic properties of carzinophilin on the meristematic cells of *A. sativum* L.).**
CR Soc. Biol., Paris 1960 : **154** : 513–17.

When tested on root-tip cells, the above antibiotic and antitumoral compound isolated from *Streptomyces sahachizoi* proved to have a mitodepressive effect at a concentration of $2{\cdot}5 \times 10^{-6}$, a chromatoclastic effect at 10^{-6}, a reversible mitostatic action after 48 hr. at 5×10^{-6}, an irreversible mitostatic action after 48 hr. at 7×10^{-6} and a lethal effect in less than 24 hr. at $1{\cdot}5 \times 10^{-5}$.

93 MCMANUS, M. A.
Certain mitotic effects of kinetin, gibberellic acid, maleic hydrazide and indoleacetic acid in onion roots.
Proc. Ia. Acad. Sci. 1959 : **66** : 74–80.

Onion root tips were treated with 1 p.p.m. and 10 p.p.m. solutions of the above substances, individually and in pairs. Kinetin alone or in any combination inhibited mitosis, while gibberellic acid and indole-3-acetic acid, separately or together, caused initial inhibition and, at 1 p.p.m., subsequent stimulation. Maleic hydrazide had an inhibitory effect, both alone and in combination, and caused mitotic aberrations at 10 p.p.m.

94 TRUHAUT, R. & DEYSSON, G.
Étude des propriétés antimitotiques de la mitomycine C sur les cellules méristématiques d'*Allium sativum* L. **(Study of the antimitotic properties of mitomycin C in meristematic cells of *A. sativum* L.).**
CR Soc. Biol., Paris 1960 : **154** : 717–21.

The above compound is mitodepressive at the low concentration of $1{\cdot}8 \times 10^{-10}$ M., chromatoclastic at $4{\cdot}4 \times 10^{-11}$ M., has a reversible mitostatic effect after 24 hr. at $1{\cdot}8 \times 10^{-9}$ M., and an irreversible one at $8{\cdot}9 \times 10^{-9}$ M., and proves lethal within 24 hr. at $4{\cdot}4 \times 10^{-8}$ M.

95 DEYSSON, G. & TRUHAUT, R.
Étude des propriétés antimitotiques de la sarkomycine sur les cellules méristématiques d'*Allium sativum* L. **(Study of the properties of sarcomycin on the meristematic cells of *A. sativum* L.).**
CR Soc. Biol., Paris 1960 : **154** : 548–51.

Sarcomycin, an antibiotic isolated from *Streptomyces erythrochromogenes*, acts as a preprophase inhibitor with neither mitoclastic nor chromatoclastic activity. Mitodepression occurs in root-tip cells at concentrations of 10^{-4}, reversible mitostasis after 48 hr. at 5×10^{-4}, irreversible mitostasis after 24 hr. at 10^{-3} and death in less than 24 hr. at 2×10^{-3}.

96 EVANS, H. J. & NEARY, G. J.
The influence of oxygen on the sensitivity of *Tradescantia* pollen tube chromosomes to X-rays.
Radiation Res. 1959 : **11** : 636–41.

The effect of oxygen concentration on the yield of isochromatid aberrations induced by X rays was studied using *Tradescantia* pollen tubes and the relation between radiosensitivity and oxygen concentration was found to be similar to that of bacterial and yeast cell suspensions; the maximum oxygen enhancement ratio of radiosensitivity, in terms of dose, was 3·4 ± 0·45.

SELLERS, E. A.
Symposium on the biological effects of radiation.
Canad. J. Biochem. Physiol. 1960 : **38** : 311–38.

The proceedings are given of a symposium sponsored by the Canadian Federation of Biological Societies and held at the University of Toronto on 11 June, 1959. Among the contributions were the following two, which deal with fundamental aspects of chromosomal and other radiation damage in both plant and animal material.

97 *Whitmore, G. F. Radiation, its primary interactions. (pp. 312–20).*

"A discussion is presented of some current thinking on the primary interactions of ionizing radiation with biological materials, including a brief discussion of ionization, excitation, the track phenomenon of charged particles, and the radiation chemistry of water. An attempt is made to correlate some of these phenomena with the variations in biological damage produced by various types of radiations incident on various biological systems and under varying conditions of oxygen tension."

98 *Clark, G. M. & Baker, D. G. Radiation, the cellular approach. (pp. 320–25).*

"The basic biological action of radiation must initially involve particular cells. The sensitivity of various cells differs but some of the differences may be due to a dose-rate effect. When cells are irradiated with doses in the lethal range, inhibition of cell division occurs. A notable feature of mitotic inhibition is that it depends not only on dose but on dose rate. Chromosome breaks produced in cells may be a visible manifestation of an interruption in chemical synthesis produced by the passage of ionizing particles. The effect of oxygen is apparently of primary importance in biological changes produced by irradiation. Almost all are decreased in its absence. The current trend in research on the cellular level is towards determining the more obscure injuries which cannot be seen under the microscope."

99 García García, M. L.
Ensayos sobre la acción del ^{60}Co en la división celular de *Vicia faba* L. **(Experiments on the action of Co^{60} on cellular division of *V. faba* L.).**
Genet. iber. 1960 : **12** : 53–97.

Plants of *V. faba* were subjected to radiation of different intensities and for varying periods of time. Observations of mitosis were made on somatic cells from leaf meristems while meiosis was observed in pollen mother cells. Details are given of the large number of aberrations induced, including the following: temporary inhibition of cellular division, appearance of micronuclei, positive and negative heteropycnosis of the heterochromatin, and distension, agglutination and fragmentation of the chromosomes. The phenomenon of delayed division was studied further by subjecting young leaf tissue from three inflorescences of a single plant to doses of 86·4, 192 and 780 r. It was found that periods of temporary inhibition occurred in successive cell divisions and alternated with periods of recovery towards a normal rate of division; the weaker the dosage rate, the more rapid was the transition to normal. A direct relationship was also observed between the colour intensity of the chromatin and the number of cells in division. It is suggested that delayed division is related to alterations in the composition of chromatin or to the mechanism of its synthesis.

The author points out that radiation effects are exerted on the chemical structure and metabolism of the chromosomes, and particularly on chromatin, and that these primary changes are responsible for the various phenomena observed.

100 Durrant, A.
Expected frequencies of chromosome associations in tetraploids with random chiasma formation.
Genetics 1960 : **45** : 779–83.

"Formulae and tables of association frequencies in tetraploids are set out assuming that the associations arise from the random formation of chiasmata between the four chromosomes".
[Author's summary].

101 Abel, W. O.
Untersuchungen über die mutagene Wirkung von Maleinsäurehydrazid an *Sphaerocarpus donnellii.* **(Investigations on the mutagenic action of maleic hydrazide on *S. donnellii*).**
Chromosoma 1960 : **11** : 322–34.

Spore mother cells at four different stages of development were treated with maleic hydrazide; 20,925 germinated spores from 8232 tetrads were investigated and 177 mutants found. Treatment during early and midinterphase resulted in the occurrence of many abnormal spore associations (monads, dyads and triads), but these associations were rare after treatment in late interphase. The number of monads increased after treatment at the end of interphase but not the number of dyads and triads. The mutagenic action of maleic hydrazide in the first and second stages of interphase was 10 times greater than in the third stage. Maleic hydrazide treatment increased the mutation rate in both heterochromatin and euchromatin, structural changes in the heterochromatin being slightly more frequent than in the euchromatin. The treatment increased the rate of chromosome mutation more than that of point mutation. The effects of abnormal X chromosomes on viability and genetic activity are discussed.

102 Wolff, S.
Radiation studies on the nature of chromosome breakage.
Amer. Nat. 1960 : **94** : 85–93.

This review refers mainly to the writer's work with *Vicia* and other plants [XXX, 2153]. Protein synthesis seems to be necessary for the rejoining of chromosome breaks and the actual bonds formed may be protein links. RNA and DNA syntheses are apparently not involved. However, protein synthesis may only be providing enzymes necessary for repairing the breaks. Instances of postirradiation metabolism modifying radiation-induced genetic damage in other organisms are mentioned.

103 Kallistratos, G.
Die Auslösung cytologischer Veränderungen bei *Vicia faba* durch die kombinierte Anwendung von Cytostatica und Steroidhormonen. **(The induction of cytological changes in *V. faba* by the combined application of cytostatic substances and steroid hormones).**
Khim. Khron. (Chem. Chron.) 1959 : **24A** : 111–14.

Seeds of *V. faba* were germinated in water and after a week the roots were placed in Knop's solution to which the compounds to be tested were added. When the roots were examined 3–4 weeks later it was found that certain compounds, such as thiocolchicine derivatives and B518, caused cell contraction and various other abnormalities, the latter compound also producing mutants. When applied in combination with steroid hormones, such as hydro-cortisone, these compounds induced multi-nucleate cells, tripolar spindles and polyploid cells.

104 OCKEY, C. N.
Induction of chromatid aberrations in *Vicia* with alkylating agents in relation to interphase chromosome arrangement.
Heredity 1960 : **14** : p. 456. (Abst.).

"Chromatid aberrations induced by a single treatment of either TEM [tretamine] or HN_2 have been studied at different recovery times. Aberrations appear in treated cells from 16–36 hours; this indicates an early interphase sensitive period. The proportion of interchanges decreases while that of intrachanges increases as interphase progresses. Changes in the relative proportions of the different types of intrachange indicate that the size of the chromosome loops involved in the aberrations decreases as interphase advances.

"During the early part of interphase aberrations are less localised in certain regions than at later periods. Distribution of the aberrations is never at random however. The regions where aberrations are concentrated can be recognised in cold treated cells as dark staining segments and are often adjacent to the pale staining regions generally referred to as heterochromatin.

"The anaphase arrangement of chromosomes appears to be retained throughout early interphase. The sensitivity of the cells during this period depends on several factors some of which control contact between and within chromosomes. The most important of these are degree of coiling, change in nuclear volume, and the amount and relative position of heterochromatin in the chromosomes. There appears to be a two stage process in the production of chromatid aberrations with these agents."

105 GIMÉNEZ-MARTÍN, G. & LÓPEZ-SÁEZ, J. F.
Acción del γ-hexaclorociclohexano sobre la división celular. (**The action of γ-hexachlorocyclohexane on cellular division**).
Phyton, Vicente López 1960 : **14** : 61–78.

The above substance is shown in this Spanish study to possess pronounced c-mitotic properties. Various aberrations induced in root meristems of *Allium cepa* are described, including accumulation of cells in metaphase, multipolar anaphases, and aneuploid and polyploid cells. There appear to be two distinct phases of action, depending on the time of application. During the first phase the "centre of attraction" is activated and divides rapidly. In the second phase, during which polyploid cells are formed, division of the centre of attraction is inhibited, and the spindle is not formed.

106 MILOSSKY, A.
Ricerche sull'azione citogenetica delle sostanze chinoliniche. (**Researches on the cytogenetic action of quinoline derivatives**).
Caryologia 1960 : **12** : 439–81.

Bulbs of *Allium cepa* were grown in solutions of quinoline and 14 derivatives at a number of different concentrations and the roots were examined cytologically after varying intervals of time. The results are described in detail. Several of the compounds were toxic in high doses and at lower concentrations induced stickiness, partial c-mitosis, chromosome fragmentation and related phenomena; many binucleate cells appeared after the roots had been transferred to tap water. The methyl quinolines were the most active but too toxic to be used for inducing polyploidy.

107 MICHAELIS, A. & RIEGER, R.
Einige experimentelle Ergebnisse zur Wirkung von Myleran auf die Chromosomen von *Vicia faba* L. (**Some experimental results on the action of myleran on the chromosomes of *V. faba* L.**).
Züchter 1960 : **30** : 150–63.

Seeds were treated with 1·0 mmol. myleran for 6 and 14 hr. and roots with 0·1–1·6 mmol. for 24 hr.; the spectrum of chromosome aberrations was similar to that produced by other alkylating and nonalkylating radiomimetic substances. The aberrations were of the chromatid type, isolocus breaks being most frequent, followed by chromatid interchanges. Contrary to the findings of Moutschen-Dahmen [cf. XXIX, 1539], chromatid interchanges were not infrequent and sister chromatid reunions after isolocus breaks occurred in centric and acentric fragments. There appeared to be a deficiency in true anaphase bridges. Aberrations were more frequent in the short m chromosomes than in the SAT chromosomes, most aberrations being found in the heterochromatic segments. About 50% of the aberrations in the seeds were induced during the recovery time and the other 50% appeared later, probably as a result of mitotic delay. Sensitivity to myleran was greatest during the first part of interphase. The number of aberrations induced increased with rise in temperature. At temperatures below 30° C. most aberrations were produced with a recovery time of 24 hr. but at 30° the peak frequency occurred with a 48 hr. recovery time. There was no alteration in the aberration frequency when root tips were treated with the metabolic inhibitors 2,4-dinitrophenol, potassium cyanide and hydroxylamine in addition to myleran. After treatment with myleran and sulphathiazol, which affects nucleic acid metabolism, the peak aberration frequency moved from the 24 to 48 hr. recovery time but the number of aberrations was unchanged. Hydrolysis reduced the radiomimetic activity of myleran. Combined treatment with myleran and ethanol had more than an additive effect, thus indicating that breaks produced by the different treatments could join up with each other.

108 Galinsky, I.
Induced subchromosome breaks in prophase of *Vicia faba*.
J. Hered. 1960 : **51** : 19–20.

Treatment of the roots with a solution of disodium phosphate resulted in breaks in the subunits of the chromosome. Although these were very difficult to observe in prophase, an exceptionally well-spread early prophase revealed chromatid and subchromatid breaks. It is suggested that these breaks may be due to interference in the synthesis of a portion of the chromosome.

109 Beatty, A. V. & Beatty, J. W.
Postirradiative effects on chromosomal aberrations in Tradescantia microspores.
Genetics 1960 : **45** : 331–44.

The effect of CO in relation to the production of chromosomal aberrations due to breakage by X irradiation in the presence of O_2 was operative on rejoining rather than breakage, since postirradiation treatment with CO yielded the same number of aberrations as treatment with this gas during irradiation. As indicated by the CO effect, all rejoining, as regards two-hit aberrations, was completed within 10 minutes after irradiation. All experiments in which irradiation was carried out in air, followed by an immediate postirradiation treatment in He, revealed a posttreatment effect, the aberration frequency being higher than that obtained with posttreatment in air. In all experiments in which He was used during irradiation, followed by a postirradiation period in air, the yield of aberrations decreased. These results are interpreted as evidence in support of the view that availability of energy for chromosome rejoining directly influences the production of two-hit aberrations in such a way that aerobic conditions after irradiation favour restitution over exchanges, while anoxic conditions after irradiation favour exchanges over restitution. The results from fractionation experiments indicated that some of the breaks produced in air or He, with postirradiation treatment in air, remained open and available for the production of two-hit aberrations for about 30 min., whereas breaks undergoing posttreatment in He remained open for a longer period. [Cf. XXIX, 3490 and XXX, 1084].

110 Sharma, A. K. & Gupta, A.
Induction of chromosome breakage through plant pigments.
Nucleus, Calcutta 1959 : **2** : 131–60.

Natural pigments extracted from Myxophyceae, Xanthophyceae and Chlorophyceae and applied to root-tip cells of *Allium cepa* were all found to possess chromosome-breaking ability. Erosion, fragmentation, formation of polyploid nuclei, multipolar configuration, multi-nucleate cells as well as somatic reduction of diploid cells were frequently observed. Extracts from the Chlorophyceae exerted the maximum effects on chromosomes, irregularities being observed after only six hours of treatment. It was noted that when the roots were placed in Knop's medium after treatment with the algal pigment, there continued to be an increase in fragmentation for some time. This indicates the partially latent nature of the chemical effect. In inducing polyploidy, Cyanophycean extracts were more rapid than the other pigments. In general, the Xanthophycean extracts were the least effective. The authors discuss the implication of these results with respect to natural mutation. Chlorophyll extracted from higher plants had an effect similar to that caused by the Chlorophycean extract, suggesting that chlorophyll may have a role in natural chromosome breakage.

111 Morrison, J. W. & Rajhathy, T.
Frequency of quadrivalents in autotetraploid plants.
Nature, Lond. 1960 : **187** : 528–30.

Earlier work on grain crops and grasses revealed that in autotetraploids about two-thirds of the chromosomes were associated as quadrivalents, irrespective of species and size and number of the chromosomes [cf. 214]. Further examination of a wider range of material was therefore undertaken, comprising groups of autotetraploids with large, medium to small and small chromosomes, respectively represented by (1) a garden hybrid of *Lilium* ($2n = 48$), *Triticum durum* ($2n = 56$) and *Avena strigosa* ($2n = 28$), (2) *Asparagus officinalis* ($2n = 40$) and *Petunia hybrida* ($2n = 28$) and (3) *Ageratum houstonianum* ($2n = 40$), *Lycopersicon esculentum* ($2n = 48$), *Raphanus sativus* ($2n = 36$), *Antirrhinum majus* ($2n = 32$) and *Kalanchoe blossfeldiana* ($2n = 68$). The results gave further support to the hypothesis that in all autotetraploids about two-thirds of the chromosomes associate as quadrivalents. Evidently chromosome size and physical interference among the chromosomes do not influence quadrivalent formation. Nor do the authors regard a trend towards bivalency or specific genetic control as playing a part in controlling quadrivalent formation in autotetraploids; reasons are also given for discounting that chiasma localization has a major influence on quadrivalent frequency.

112 MOORE, D. M.
Chromosome numbers of flowering plants from Macquarie Island.
Bot. Notiser 1960 : **113** : 185–91.

Chromosome counts for 22 of the 31 angiosperms occurring on this subantarctic island show that the level of polyploidy (61·5%) corresponds to that found at rather higher latitudes in the northern hemisphere.

113 MULLIGAN, G. A.
Polyploidy in Canadian weeds.
Canad. J. Genet. Cyt. 1960 : **2** : 150–61.

The incidence of polyploidy in the common, widespread native and introduced weeds of Canada was about the same as in the general flora of that country. The occurrence of open habitats does not necessarily favour polyploidy in weeds. The incidence of polyploidy was 39% in annual weeds, 33% in biennials and 55% in perennials. The incidence of this condition differed according to habitat, being respectively 37, 56, 52 and 49% in weeds of grain fields, row crops, hay fields and pastures. The relatively high frequency of polyploidy in hay-field and pasture weeds is attributed to the predominance of perennials in these habitats. The lower incidence of polyploidy among grain-field weeds is ascribed to natural selection for annual habit and genetic stability, both of which are found to a greater degree among diploids. The high percentage of polyploids in row crops is partly due to the presence of a few rhizomatous perennials. It is however mainly attributable to selection, through repeated cultivation, for annual weeds with genetic variability, a characteristic more common in polyploids than diploids.

114 KING, J. R.
The peroxidase reaction as an indicator of pollen viability.
Stain Tech. 1960 : **35** : 225–27.

This test is based on the oxidation of benzidine by peroxidase in the presence of hydrogen peroxide; the reaction in the pollen grain is accompanied by the emission of oxygen which is freed from the hydrogen peroxide by catalase. Pollen is dusted on the medium in a Petri dish; the medium consists of 10 ml. of 2% agar, 5 ml. of hydrogen peroxide and 1·8 ml. of 1% benzidine base in 60% ethyl alcohol. Four pollens have been tested and so far the reaction has been specific for each kind of pollen, although similar for related species. With sweet potato and sugar cane the intensity of blue colour in the grain is a measure of the viability; the estimation is best made 10 to 30 min. after the pollen is sown on the fresh medium. In potato and tomato, viable grains quickly enlarge, appear colourless and are ovoid in shape, and nonviable grains become blue and do not enlarge; the test reaction reaches its maximum within 5 min.

CROP PLANTS

115 **The Agriculture Division of FAO. A summary of its organization, development and accomplishments from 2 December 1946 to 31 December 1958.**
FAO UN, Rome 1959 : No. B–1210 : Pp. 301. (Mimeographed).

Projects concerned with (1) maize, rice, wheat and barley breeding, (2) services to plant breeders and (3) crop exploration, collection and introduction are among the activities summarized.

Eucarpia. Second Congress of the European Association for Research on Plant Breeding.
Köln 1959 : Pp. 280.

116 *Jucci, C. Wild plants and anthropic influences on biological equilibrium. (pp. 12–26).*

A general discussion is given of the potentialities still remaining for the exploitation of wild plants in crop improvement, with a warning note on the threat against the continued existence of wild plants and primitive cultivated forms as the result of man-made disturbances in biological equilibria, such as those brought about by the use of herbicides and insecticides and by vegetational modifications.

117 *Kuckuck, H. Über das Vorkommen von* Triticum Spelta *im Iran, mit einem Beitrag zur Entwicklung der hexaploiden Kulturweizen. (On the occurrence of* T. spelta *in Iran with a contribution to the development of hexaploid wheats). (pp. 27–34).*

Some information is provided on the author's plant collecting expeditions in Iran. Much variation was found amongst the wheat populations, this being the result of differing climatic conditions and cultivation. *T. aestivum* was growing in all parts of the country and showed the greatest variation and adaptation; *T. compactum* was found in markedly different regions in admixture with *T. aestivum*. *T. durum* occurred mainly in regions with favourable climate; *T. turgidum*, *T. turanicum* and *T. dicoccum* were less widespread. *T. spelta* was found in a restricted region on a high plain in the Baktian country [cf. XXVIII, 1509]. The Iranian spelt resembles the European forms in the characters by which *T. spelta* is recognized. Whilst the uppermost spikelets of the European forms frequently fall off after harvesting, either spontaneously or when touched, this does not occur in the Iranian spelt; it also differs from the European spelt in other ear characters. Gökgöl, who also examined the material, is of the opinion that the European and Iranian forms and *T. macha* from the Caucasus are three distinct species. It is not thought that the Iranian form was introduced from Europe.

When a form of *T. spelta* from Asturias was crossed with *T. macha*, naked-grain forms of vars. *subcompactum* and *compactum*, Squarehead and simple dense-eared types were found in the F_2 and F_3 progenies; there were also some forms intermediate between spelt and naked wheat. In crosses of Iranian spelt with the spelt from Asturias and *T. spelta* 'Zuzger Weisskorn' [Zuzger White Grain], similar forms were produced but with different frequencies. Some naked-grain forms with tough rachides produced in the F_4 some dense and brittle eared plants with naked ears, frequently of *compactum* or *subcompactum* type. The possible mode of origin of these new combinations is discussed. Chromosome bridges have been observed and indicate that, by unequal crossing over, alterations of individual chromosomes with duplications and deficiencies are to be expected. Chromosome IX, which carries *Q*, the suppressor of the spelt character, and *B* which inhibits awn development, are probably involved in such changes. This is indicated by the occurrence of some almost unawned plants amongst the F_1 of *T. spelta* (Asturias) x *T. macha*, both parents being awned. The results of these crosses indicate that the genomes of *T. spelta* (Asturias) and *T. macha* differ in structure and that the genome of *T. spelta* (Iran) differs from that of both Zuzger Weisskorn and *T. spelta* (Asturias). These findings support the view that *T. spelta* (Iran) is a native of Asia; this does not exclude the possibility that the Iranian and European spelts had a common origin.

Spelt is thought to be the prototype of hexaploid wheat [cf. XXX, 288]. All hexaploid wheats hitherto synthesized have brittle ears like spelt. Amphidiploids of crosses between *T. dicoccum* or *T. dicoccoides* and *Ae. squarrosa* are identical genetically with spelt. Since it is known that hexaploid wheats obtained the D genome from *Ae. squarrosa*, the original wheat must also have been brittle and it is concluded that existing spelt is identical with this form.

The question of how naked cultivated forms may have originated from *T. spelta* is also discussed. Some naked spelt forms were found in Iran and these may have arisen by mutation; crosses of different hexaploid spelts could have given rise to naked forms with a tough rachis.

118 *Nilan, R. A. Radiation induced mutation research in the United States of America. (pp. 36–47).*

Published information on the application of ionizing radiations in the USA is reviewed, the greater part of the paper dealing with the experimental control of the process of induced point mutation, with reference to ionization density, moisture content of the material treated, after-effects of radiation, temperature, the nature and relation of chromosome breakage and aberrations, and the effects of chronic radiation. Sections are also given surveying the development of induced-mutation breeding, practical results of such breeding, pollen irradiation and other uses of radiation in breeding besides induction of mutations.

119 *Hoffmann, W. Zum Fertilitätsproblem polyploider Pflanzen. (On the fertility problem of polyploid plants). (pp. 48–64).*

In this detailed review, ways in which a regular distribution of chromosomes may occur in polyploids are considered and the possibilities of improving fertility by selection are discussed.

120 *Gaul, H. Determination of the suitable radiation dose in mutation experiments. (pp. 65–69).*

In experiments with X-irradiated seeds of barley, the following were correlated: (1) reduction in seedling growth, (2) killing effect on R_1 plants and (3) mutation frequency. Within reasonable limits, this correlation allows the prediction of both (2) and (3) by preliminary testing of (1), in which the length of the first leaf in seedlings from samples exposed to a range of doses is measured. The mutations recorded were all chlorophyll changes.

121 *Scheibe, A. Mutationsauslösung durch Chemikalien bei Gerste und Weizen. (Mutation induction by chemicals in barley and wheat). (pp. 69–75).*

The ears of spring barleys and wheat were treated just before meiosis with solutions of $AlCl_3$, glycol, mixtures of ethylurethane and KCl and of glycol and KCl, morphine, atropine and scopolamine; the treatment involved making a cut below the highest node and lifting up a small piece of stem which was introduced into a test tube containing the experimental solution. Certain concentrations of $AlCl_3$ and the mixture of ethylurethane and KCl had most mutagenic effect; good results were also obtained with atropine and scopolamine. Seven wheat mutants and one barley mutant were distinguished in the C_1 generations. In the C_2 there were 30 wheat mutants and 31 barley mutants and some of these showed changes in several characters.

122 *Favret, E. A. Mutation research on crop plants in Argentina. (pp. 76–77).*

Work begun in 1949 at the Instituto de Fitotecnia, Castelar, is reviewed, the results of the following lines of investigation being summarized: (1) the divergent mutagenic effects of formaldehyde and urethane upon barley; (2) decreasing the chromosome-breakage effect of ionizing radiations without changing the mutation rate, by protective chemical action; (3) modification of mutagenesis by treatments of several and consecutive generations with ionizing radiations; (4) induction of barley mutants resistant to mildew by γ-ray, fast neutron and formaldehyde treatments; (5) induction of mutation for disease resistance in wheat, one mutant resistant to race 15B of stem rust having been obtained through γ-ray exposure of Sinvalocho MA; and (6) irradiation of Chinese Spring monosomics. Several other projects initiated on oats, wheat, rye, sunflower, *Cucurbita maxima* and beans are listed.

123 *Noulard, L. Mutations induites par rayons X chez* Triticum aestivum. *(Mutations induced by X rays in* T. aestivum). *(pp. 78–81).*

The progeny of plants of *T. aestivum* exposed to X rays exhibited a considerable range of mutations; 54% of the mutations affected the height of the plant, while another 41·5% influenced ear characters. Details are given of the various types of mutations produced, although only a few, such as short straw, increased fertility and heavier grain, could be considered to have any potential practical value.

124 *Hänsel, H. Vergleichende Untersuchungen über Entwicklung, Trockensubstanzzuwachs und assimilierende Oberfläche einer Erectoides-Mutante und ihrer Stammform* (Hordeum distichon, nutans) *im Hinblick auf die Ertragsbildung. [Comparative investigations on the development, dry matter increment, and assimilating surface area of an erectoides mutant and its original form* (H. distichon nutans) *with regard to yield make-up]. (pp. 82–84).*

An *erectoides* mutant (Er. 503) was obtained by irradiating seed of Probstdorfer Vollkorn [Probstdorf Round Grain] (VK41) with 9400 r. of X rays. In 1953 the F_1 of the cross VK41 x Er. 503 showed heterosis in several characters. In the less favourable year of 1957 the same cross and its reciprocal showed no heterosis and VK41 was dominant in all investigated characters. The F_2 and F_3 showed that the short stem and dense ear of Er. 503 were controlled by a recessive gene. In young seedlings and mature plants the length/breadth ratios of the seed, leaf lamina, longitudinal stem section and the anther were smaller in the mutant than in VK41; also the cells lying between the stomatal pores were shortened. The stem length of Er. 503 was about 86% of that of VK41; the relative lengths of the rachis and stem internodes in relation to the total length of rachis and stem were similar in the mutant and original form; this was true in all the developmental stages investigated.

Dry weight of ripe ears was 23% lower in Er. 503 than in VK41 in a test where no lodging occurred. It is supposed that this difference is related to the small size of the green surface area of the stem and ear in the mutant at the time of grain formation, most of the leaves having withered. It is emphasized that the effect of stem length and ear form on grain yield should be considered in breeding plants for dry regions. Treatment with gibberellic acid and 2,3,5-triiodobenzoic acid did not show that the *erectoides* gene acted on plant dimensions through the production of these substances.

125 *Persson, A. R. Physiological and genetical investigations on an* aurea *mutant in tomato.* (*pp. 84–99*).

Investigations were carried out on an X-ray induced *aurea* mutant ($A/+$), dependent, like other *aurea* mutants in higher plants, upon an incompletely dominant gene. The yielding ability of $A/+$ plants was tested under various environmental conditions; in most cases they yielded less than $+/+$ plants. Broadly speaking, $A/+$ plants showed the same reactions to temperature and day lengths as $+/+$ individuals but certain differences in response were noted, as well as in the effect of light intensity. Disparities were also found in the gross chemical composition of the leaves of $A/+$ and $+/+$ plants and in the effect of gibberellic acid. The dosage effect of A was analysed in diploids, tetraploids, trisomics and a single triploid, in terms of chlorophyll content. The dosage effect was geometric rather than arithmetic but the increment in amount of chlorophyll did not follow a constant factor. The dosage effect was greatly influenced by temperature and day length.

126 *Schwarze, P. Beobachtungen über gesteigerte Flavonoidproduktion in* Phaseolus-*Artbastarden.* (Phaseolus vulgaris x Phaseolus coccineus). [*Observations on the increased flavonoid production in* Phaseolus *interspecific hybrids.* (Ph. vulgaris x Ph. coccineus)]. (*pp. 104–11*). [Cf. XXX, 2064].

127 *Sánchez-Monge, E. Cereal breeding problems in Spain.* (*pp. 115–19*).

Problems of breeding wheat, oats, rye, maize and barley and ways in which they are being tackled are described. In the case of rye, production of a 4*x* commercial variety and work on *Triticale* are mentioned, and for maize the first results of work on hybrid production are briefly given.

128 *Zadoks, J. C. On the formation of physiologic races of plant parasites.* (*pp. 119–20*). (*Abst.*).

This is an abstract version of an article already summarized [cf. XXX, 1358].

129 *Dionigi, A. Résultats de la Conférence* Durum *à Foggia* (*2–3 mai 1959*). [*Results of the* Durum *Conference at Foggia* (*2–3 May 1959*)]. (*pp. 123–27*).

Both Mičurinist and mutation techniques have failed to lead to substantial improvements in *Triticum durum* at the Bari Experimental Station. The author describes a method, referred to as Italian genetics, whereby the rhythm of development was transformed. Hard wheat is characterized by a short vegetative phase followed by a prolonged reproductive phase, a developmental cycle which leads to lack of resistance to unfavourable conditions in both summer and winter. To transform this, hybridization with *T. vulgare* proved unsuccessful because of the sterility problem in the hybrids. However, success was achieved by hybridization of *T. durum* 'Cappelli' with *T. turgidum*; a new type of hard wheat, with a prolonged vegetative phase and a rapid reproductive phase, was obtained.

130 *Rigot, N. Travaux de la Station de Recherches Libramont pour l'amélioration de la résistance de la pomme de terre aux viroses.* (*Work of the Libramont Research Station for the improvement of virus resistance in the potato*). (*pp. 132–39*).

Observations on several potato varieties in Belgium have shown that the following varieties possess some resistance to leaf roll; Électre, M2, Augusta, Érato, Eschyle and the American hybrid 1276–185, derived from a cross between Houma and Katahdin. It was also shown that the degree of transmission of this virus by means of the tubers varies considerably from one variety to the other. Clones of *S. andigenum* were far more resistant to leaf roll than *S. tuberosum* varieties.

A detailed account is given of work designed to improve resistance to virus Y, using *S. stoloniferum* material as well as varieties such as Aquila and Katahdin, which have shown some resistance to that virus. One clone, 75/65, has thus far succeeded in remaining 100% free of either virus Y or leaf roll and is to undergo further study.

131 *Huysman, C. A. Neue Entwicklungen in der Züchtung von resistenten Kartoffeln gegen* Heterodera rostochiensis. (*New developments in the breeding of potatoes resistant to* H. rostochiensis). (*pp. 139–43*).

Mention is made of the breeding of resistant varieties in Holland using *Solanum andigenum* '1673' [cf. XXX, 2313]. Testing for resistance to biotypes of *H. rostochiensis* is also considered. *S. kurtzianum* appears to carry two dominant polymeric genes for resistance to biotype B. When the resistant species *S. vernei* and *S. famatinae* are crossed with susceptible types the progeny does not segregate clearly into resistant and susceptible types, there being many intermediates; the resistance may be controlled by several dominant genes with additive effect or by a few possibly polymeric genes each of which confers a lower resistance than gene *H* of line 1673. Mention is made of the existence of strains of biotype B differing in pathogenicity. At Wageningen a collection of cysts of different origin is being established which will be used in testing the resistance of wild species to the different biotypes. It is thought that it would be worthwhile to search for strains of *S. andigenum* resistant to biotype B.

132 *Jacobsen, B. Methods for testing potato seedlings to determine resistance to common scab? (pp. 144–45).*

According to preliminary results at the Potato Breeding Institute, Vandel, Denmark, testing seedlings by growing them in scab-infested perlite offers a promising method. Perlite is described as crushed pumice specially treated by heating.

133 *Ross, H. Ökologisch-pflanzengeographische Beobachtungen zu Resistenzfragen an knollentragenden Solanumarten Südamerikas. (Ecological and plant geographical observations concerning resistance problems in tuber bearing* Solanum *species of South America). (pp. 145–56).*

[Cf. 646].

134 *Frandsen, K. J. The breeding of root forage plants. (pp. 163–68).*

After discussing the general problems of individual-plant evaluation, methods of progeny testing for assessing combining ability of the individuals selected and maintenance of sufficient variability in breeding populations of root-forage crops, the author turns to some special problems in swede and mangel improvement with reference to experience in Denmark.

135 *Hutin, C. Amélioration des plantes fourragères pour le rendement. (The breeding of forage plants for yield). (pp. 168–75).*

The author discusses some of the difficulties encountered in the improvement of forage plants. Three major problems are dealt with: the actual methods of selection, the evaluation of the results and the definition of yield in forage crops.

136 *Hackbarth, J. Eindrücke über die Züchtung von Futterpflanzen in Polen. (Impressions of the breeding of fodder plants in Poland). (pp. 176–79).*

The impressions reported here were gained at a symposium in Poznań in 1958 [cf. XXIX, 1626]. Mention is briefly made of the problems being investigated and some of the results attained in breeding forage plants.

137 *Andeweg, J. M. The breeding of cucumbers. (pp. 183–85).*

Changes in cucumber-growing practices in the Netherlands during the past decade are outlined in relation to the achievements and problems of breeding. Recently cultivation in frames has gradually been replaced by glasshouse growing but both the older and new scab-resistant varieties have shown a pronounced tendency to produce bitter fruits. The author gives an account of investigations [cf. XXIX, 4577] initiated at the Institute of Horticultural Plant Breeding, Wageningen, to discover whether this problem can be solved by breeding varieties which completely lack the bitter principle, both in the fruits and vegetative parts, the character of nonbitter vegetative parts being sought so that selection could be made before having to wait until fruit formation.

138 *Huyskes, J. A. A method for selecting asparagus varieties with a long fibreless top. (pp. 185–87).*

A longer fibreless top would make it possible to remove the fibrous lower part of the spear by mechanized cutting instead of, as at present in processing in the Netherlands, peeling by hand. The method of selecting for such a top has already been described elsewhere [cf. XXIX, 4545].

139 *Reimann-Philipp, R. Cytologische Untersuchungen zur Identifizierung der Geschlechts-chromosomen bei Spargel* (Asparagus officinalis). [*Cytological investigations on the identification of the sex chromosomes in asparagus* (A. officinalis)]. (*pp. 189–90*).

[Cf. XXX, 4362].

140 *Kappert, H. Bericht über die Versuche zur Erzeugung rein männlicher Nachkommenschaften beim Spargel. (Report on experiments on the production of pure male progenies in asparagus). (pp. 190–91).*

Breeding of asparagus at Berlin-Dahlem was based on the views of Correns concerning the mode of action of the sex determinants; it was supposed that all the genes controlling sexual characters are present in every individual and additional inhibiting or promoting factors determine which characters are expressed. If all the male determining genes are designated *A* and the female genes *G*, then in the case of male heterogamy the two sexes may be symbolized by $(AG)_2Mw$ and $(AG)_2ww$. Disturbances in the balance between the sex genes and other factors lead to the development of intersexes. Some male plants were found with single hermaphrodite or female flowers. From such plants carrying *Mw*, both *M* and *w* egg cells were produced and these on pollination with *M* and *w* pollen gave a progeny of 1*MM* : 2*Mw* : 1*ww*. The *MM* types were found to be viable. It has been established that male plants yield on the average 50% more than the female plants. Attempts were made to distinguish the *MM* types; the war interrupted the investigation which has not been intensely worked on again.

141 *Haigh, J. C. Asparagus breeding in England.* (*p. 192*).

Breeding was initiated at the National Vegetable Research Station, Wellesbourne, England, only in 1954. Homozygous plants have been isolated but not yet selected for commercial qualities. Such plants vary in capacity to bear berries, suggesting the possibility of synthesizing the bisexual form. Tetraploids produce somewhat larger spears than diploids but have a lower yield. Considerable plant-to-plant variation suggests, however, the possibility of combining large spears and high spear number.

142 *Nybom, N. Some general aspects on fruit breeding.* (*pp. 192–98*).

With reference to experience with tree fruits at the Balsgård Fruit Breeding Institute, Sweden, as well as in other countries, the author comments on (1) various characters whose nature and inheritance require further elucidation, e.g. disease reactions, anthocyanin pigmentation, winter hardiness and storage properties, and (2) the need for more efficient methods of selection and of analysis of reactions and constituents. In connexion with the development of better procedures of selection, the importance of finding correlations between vegetative characters, particularly of the seedlings, and fruit characters is emphasized, work initiated in this field by the author and other investigators being discussed. In addition, it is suggested that genes, such as the recessive one for lack of acidity in apple and certain *S* alleles for sterility in cherries, which apparently have some selective advantage when heterozygous but no beneficial effect when homozygous, offer an interesting problem.

143 *Passecker, F. Probleme und Methoden der Obstzüchtung im Gebirgsland.* (*Problems and methods of fruit breeding in the mountains*). (*pp. 198–202*).

The author considers the characters of the climate to which plants must be adapted in mountainous regions 500 m. or more above sea level. Mention is made of work being carried out at Imst in the Tyrol where new varieties and rootstocks are being developed. Special attention is paid to breeding fruit trees which will grow on their own roots for these have been found to be more frost resistant than grafted trees.

144 *Zwintzscher, M. Die Auslösung von Mutationen als Methode der Obstzüchtung.* (*The induction of mutations as a method of fruit breeding*). (*pp. 202–11*).

In this general review it is shown that the mutation method may be successfully applied in fruit breeding and that the failure of early experiments resulted from technical difficulties. It is shown that the primary effects of irradiation depend on the type of treatment and dose and that by using special methods for the production of chimeras and the isolation of mutants many different types of both may be obtained. On account of diplontic selection it is necessary to develop methods which exclude competition between mutant and nonmutant cells.

145 *Williams, W. Selection of parents and family size in the breeding of top fruits.* (*pp. 211–13*).

Based upon experimental observations on the apple, the problems of (*a*) choice of parents and (*b*) family size in breeding for polygenic characters are analysed. It has been demonstrated for a wide range of characters that only those parents combining maximum expression for the desired characters are likely to yield the greatest result for a minimum of effort. The choice of parents for any given combination of characters may therefore be narrowed down to a very few. A reasonable estimate based on experimental results for five desirable characters such as, primarily, (1) mildew resistance and, additionally, (2) fruit size, (3) season of maturity, (4) skin colour and (5) flavour and texture, would be 40, 20, 20 10 and 10% respectively. Assuming independent assortment for the five characters and allowing for others which cannot readily be included in the calculation as well as purely subjective judgments, it is concluded that the optimum family size for giving at least 5 selections for final selection would be 31,250. It is suggested that such a high number may be reduced by (1) selection at the seedling stage, e.g. for mildew or scab resistance, (2) the discovery of correlations of vegetative seedling characters with fruit characters and (3) breeding parental varieties with high degrees of expression of specific characters, although otherwise unsatisfactory from the commercial point of view.

146 *Knight, R. L. Notes on small fruit breeding at East Malling. (p. 214).*

A brief account is given of the following lines of work at the East Malling Research Station, England: (1) genetics of resistance to *Amphorophora rubi* in raspberry; (2) inheritance of tip rooting in *Rubus occidentalis* and suckering in the red raspberry, respectively found to depend on a dominant and recessive gene which are independent of each other; and (3) the production and back crossing of amphidiploids of black currant x gooseberry and other *Ribes* amphidiploids.

147 *Verlesung der von Hofrat Dr. h.c. Erich Tschermak-Seysenegg übersandten Begrüssungsansprache. (A reading of the welcoming address sent by Hofrat Dr. h.c. Erich Tschermak-Seysenegg). (pp. 225–28).*

The author recalls some of his experiences as a plant breeder, special mention being made of successes in cereal and vegetable breeding resulting from the use of seed obtained from other breeders in many parts of the world. The importance of exchanging seed and information is stressed.

148 *Rudorf, W. Plant breeding in Germany. (pp. 228–34).*

After surveying the historical background to crop breeding in Germany from the early nineteenth century to the beginning of the present one, the author describes the impact of world war II, the relative importance of scientific institutes and private bodies in breeding in the Federal Republic, ways in which cooperation between practical breeders and the scientific institutes is promoted, and the scheme in operation for breeders' rights and protection.

149 *Hagberg, A. Barley mutations used as a model for the application of cytogenetics and other sciences in plant breeding. (pp. 235–48).*

A survey is given summarizing the main features of the information gained at Svalöf, Sweden, on the phenotypic effects, physiological nature, genetics and cytogenetics of the *erectoides* mutants induced in barley by ionizing radiations. The technique used for determining breakage points of induced translocations, by means of a tester set of translocation lines, is also described, the ultimate aim of such analysis being the production of directed mutations by duplication and deletion of specific segments with the aid of the differential action of various mutagens. A tentative map of the chromosomes of barley is provided, summarizing cytogenetical data so far obtained.

150 *D'Amato, F. Cytological and genetical effects of chemical mutagens. (pp. 248–53).*

With reference to investigations reported by himself and his colleagues and by other workers, the author discusses the effects of mutagenic chemicals, drawing attention to differences and similarities between the action of chemicals and ionizing radiations.

151 *Straub, J. Struktur und Wirkungsweise der Selbststerilitätsgene. (Structure and mode of action of the self-sterility genes). (pp. 253–56).*

Two types of self sterility are distinguished. One of these is controlled by the gametophyte; the growth of the pollen tube is inhibited in the style after self pollination. Linskens found in *Petunia* that the proteins present in the style after self pollination differed from those present after cross pollination. Grafting experiments indicated that the substances peculiar to the pollen and dependent on the *S* gene have the character of enzymes and are produced in specific quantities in the pollen. The second type of self sterility is under sporophytic control; the pollen tube tip or pollen membrane carries the pollen inhibitor. After selfing the pollen is unable to penetrate the cuticle of the stigma.

Self sterility genes consist of subunits. Lewis obtained mutants of *Oenothera organensis* whose pollen behaved differently but the reaction of the style was unchanged and he concluded that one part of the *S* gene controlled the pollen reaction and the other the style reaction. In the progeny of certain *Petunia* trisomics, self-fertile plants have occurred contrary to expectation. Their characteristics in crosses with plants of known *S* gene constitution may best be explained by assuming that an exchange occurred within the *S* locus.

152 *Cauderon, A. Hétérosis et sélection réciproque chez le maïs. (Heterosis and reciprocal selection in maize). (pp. 256–64).*

Included in this review is a description of the system of reciprocal selection, as employed at Versailles and elsewhere. The system, which involves the use of both European (D) and North American (C) lines, attempts to make full use of hybrid vigour. C x D hybrids proved to be superior in yielding ability to either C x C or D x D hybrids, while of the double hybrids, those with a (C x C) x (D x D) constitution were outstanding.

Huitième Congrès International de Botanique, Paris, 1954. Actes du Congrès et dernières communications reçues. **(Eighth International Botanical Congress, Paris, 1954. Acts of Congress and last communications received).** 1959 : Pp. 270.

Two appendices contain papers omitted from preceding volumes [cf. XXV, 2563 and XXVIII, 3821] due to late receipt and an index of the reports, communications and special notices of the Congress.

153 *Clémencet, M. Pour une nouvelle classification des orges cultivées. (For a new classification of cultivated barleys). (pp. 220–22).*

Based on the *Latisquamosae* and *Parvisquamosae* of Bergal [cf. XXII, 2706] it is proposed that *Hordeum sativum* should be split to form two species, *H. latisquamosum* and *H. parvisquamosum*, each comprising both two and six-rowed barleys. These two species can then be subdivided on the basis of number of fertile flower rows to give the four Linnaean species, *H. vulgare*, *H. distichum*, *H. hexastichum* and *H. zeacrithum*, and *H. deficiens*. The Linnaean species are then further divided according to ear compactness.

154 *Hawkins, R. P. Investigations of strains of red clover. (pp. 222–23).*

Investigations on the classification of red clover strains at the National Institute of Agricultural Botany, Cambridge, are reported [cf. XXIV, 1181, XXV, 1148].

155 *Chopinet, R. & Dumardin, J. Étude de quelques populations d'*Arrhenatherum elatius *en vue de leur utilisation agronomique. (A study of some populations of* A. elatius *with a view to their agronomic utilization). (pp. 223–24).*

In the 26 ecotypes studied the yield varied widely, being influenced by amount of the first cut and ability of the plants to grow back after cutting. The early types were very vigorous, allowing 4 or 5 cuttings while the later types, although less able to withstand cutting (2 cuts), gave good total yields owing to the abundance of the first cut.

The very early growth of this species varied little among the different ecotypes, although differences of up to 40 days were found in date of flowering. It is concluded that it should be possible to select lines suitable for inclusion in high-yielding forage mixtures and adapted to different growing conditions.

156 *Bouychou, J.-G. Explication possible du comportement génétique de l'*Hevea brasiliensis *en Extrême-Orient. (A possible explanation of the genetic behaviour of* H. brasiliensis *in the Far East). (p. 242).*

It is pointed out that, since most of the plantations in the Far East are derived from a relatively small number of trees introduced at the end of the last century, the lack of vigour noted in some clones may be due to inbreeding.

157 **Report of the Rothamsted Experimental Station for 1959** (1960) : Pp. 288.

The following investigations having bearing on the genetical improvement of crops have been singled out for mention:—

Cereals. The part played in wheat and barley by disparities in photosynthetic capacity in varietal differences in yield was further analysed [cf. XXIX, 3505]. A previous conclusion that ears of Proctor barley have a higher net photosynthetic efficiency than those of Plumage Archer was confirmed. The contribution to total grain yield made by photosynthesis in the ear is thus greater for Proctor since this variety produces more, although smaller, ears than Plumage Archer.

Clovers. The results from crosses among red-clover plants showing different responses to a phage-induced mutant of an ineffective bacterial strain designated Coryn suggested that effectiveness towards this strain was controlled by a dominant host factor or complex. Work on variation in symbiotic effectiveness in subterranean clover, begun in Australia, ended. All the 15 isogenic varieties examined depended basically on the same genotypic control of nitrogen fixation and assimilation, in spite of great disparities in other properties. Intervarietal hybridization led to marginally higher yields in the F_2, this increase declining in the F_3 and being lost upon further breeding. The small gains could not be maintained by selection and further crossing. Work continued on inheritance of nodule size and abundance in subterranean clover and on selection for ineffectiveness in red clover when inoculated with a normally effective strain.

Potato. Using the varieties previously studied and also Ackersegen, Ås and Ontario, further experiments were carried out on the nature of haulm resistance to *Phytophthora infestans* [cf. 1703]. In addition, 45 commercial varieties of all maturity groups were tested as potted plants, susceptibility of the leaf and leaf axil to infection, sporing capacity and rate of advance of the fungus within leaf tissue being determined [cf. XXIX, 3506]. Early varieties were the most susceptible in all respects and, in general, resistance increased with lateness of the variety.

Sugar beet. Some of the material selected for tolerance of yellows virus outyielded commercial varieties where this disease, aphid infestation and drought were severe.

Hop. Evidence was obtained suggesting that a system resembling parasexuality allows genetic recombination in *Verticillium albo-atrum*.

Pea. Further tests of varietal resistance to *Fusarium* wilt were conducted [cf. XXX, 4470].

The Research and Experimental Record of the Ministry of Agriculture, Northern Ireland 1958 (1959) : **8** : Pp. 254.

158 *Chestnutt, D. M. B. & Brown, S. M. Strain trials of perennial ryegrass* (Lolium perenne *L.*) *for seed production and other growth features. Part II.* (*pp. 91–101*).

Tabulated information is given on seed and herbage yields, 1000-seed weight, percentage of blind seed disease and *Fusarium* infection, and germination percentage of various *L. perenne* strains, together with observations on lodging and maturity. Irish Commercial and Devon Eaver gave the highest yields of disease-free seed under the conditions of these trials.

159 *Agricultural entomology division.* (*pp. 103–14*).

Potato. Screening of seedlings for resistance to *Heterodera rostochiensis* was continued; of 340 seedlings from crosses of commercial varieties with resistant *S. andigenum* and *S. vernei* strains, approximately 30 per cent show a high degree of resistance.

160 *Plant breeding division.* (*pp. 155–71*).

Oats. The back-crossing programme involving several commercial varieties and mildew-resistant *Avena byzantina* varieties was continued; some of the BC_5 lines show a high degree of uniformity, closely resembling their commercial parents. Segregates combining stiff straw with high yield and grain quality were selected from the F_2 of crosses involving Forward, Blenda, Sun II, Stormont Iris and Stormont Grandee.

Ryegrass. Large numbers of seedlings are being tested for resistance to *Gloeotinia temulenta*. One variety, Hooitype BC, had a markedly higher proportion of resistant plants than any of nine other varieties examined.

Potato. Breeding for resistance to late blight and dry rot was continued. Eelworm-resistant material derived from *S. tuberosum* ssp. *andigenum* 'CPC1685' was used in crosses with blight-resistant varieties and seedlings. Attempts are being made to transfer scab resistance from Canadian and European material to commercial varieties. Varieties carrying hypersensitivity genes for resistance to viruses X, A, B and C were widely used in the crossing programme; several crosses were made to transfer to commercial varieties the resistance of *S. phureja* to virus Y. The old variety Shamrock, which is resistant to leaf roll, is also being used as a parent.

Flax. Selections homozygous for resistance to *Polyspora lini* are being bulked for yield trials. Further selections were made from the F_1, F_2 and F_3 of crosses made to improve standing ability.

161 *Plant pathology division.* (*pp. 173–95*).

Potato. Varieties grafted with virus-Y-infected scions of Arran Pilot were classified on the basis of their reactions. Progenies from some of these were grown in the field in the following year together with virus-free stocks; symptoms identical with those of the parents appeared in the progenies, but considerable differences were observed among the nongrafted stocks. Seedling screening for resistance to viruses X, A and B is under way.

Flax. Breeding for resistance to *Polyspora lini*, *Colletotrichum linicola* and foot rot (*Phoma* sp.) was continued. A number of promising lines have been selected from La Plata x Tekstilščik [Textile Worker].

162 *The horticultural centre.* (*pp. 223–31*).

Strawberry. From the results of variety trials conducted at the centre, it is concluded that only the red-core resistant varieties Talisman and Cambridge Vigour can be recommended for planting in Co. Armagh.

Brussels sprouts. In trials of Irish Stock varieties, Irish Stock 74/56 has outyielded the control variety Cambridge 1.

Tomato. The variety Syston Cross showed no trace of *Cladosporium fulvum* and was the highest yielding of six varieties tested.

163 *Potato variety and registration trials.* (*pp. 247–54*).

Descriptions are given of Ulster Ranger, Ulster Glen and seedling 480/51 [cf. XXVIII, 4373]; the seedling has now been named Stormont Four Eighty. Ulster Grove is a new early maincrop variety which matures slightly earlier than Majestic. Its blight resistance is similar to that of Majestic and scale infection is negligible. The white-fleshed tubers are short oval and similar in colour to King Edward VII.

Report of the Welsh Plant Breeding Station, University College of Wales, Aberystwyth 1956-1958 (1959) : Pp. 80.

164 *Beddows, A. R. Grass breeding.* (*pp. 7–14*).

Dactylis. The survey of wild species was continued, and diploid and tetraploid ecotypes found include: *D. maritima* (tetraploid) which is a hardy winter green maritime species characterized by soft foliage and a prostrate, densely-tillering habit; and *D. glomerata* ssp. *lusitanica* (diploid) which is tall, vigorous and winter green. The interfertility of seven diploid sub-species and the relationship between the three tetraploids *D. maritima*, *D. glomerata* ssp. *glomerata* and *D. glomerata* ssp. *hispanica* were studied; the results suggest that taxa with the same chromosome number are interfertile. The progenies obtained from crosses of triploid female with diploid and tetraploid male parents include a proportion of fertile hybrids with 14 or 28 chromosomes. A study of epidermal-cell type in *D. maritima* and its allies showed the inheritance of cell type to be under polygenic control.

Lolium. Investigations into the agronomic value of *L. perenne* x *L. italicum* hybrids were continued; the viability of seed from these crosses was generally greater when *L. italicum* was the female parent. The four intergeneric hybrids possible between *L. multiflorum* ($2n = 14$), *L. perenne* ($2n = 14$), *Festuca pratensis* ($2n = 14$) and *F. arundinacea* ($2n = 42$) were obtained; all were sterile. Colchicine treatment of five F_1 *L. multiflorum* x *F. arundinacea* families with $2n = 28$ resulted in the production of a few fertile florets; seeds obtained by inter-crossing these gave rise to reasonably vigorous plants with $2n = 56$. Individual plants from *L. multiflorum* x *F. pratensis* and *L. perenne* x *F. arundinacea* were selected for colchicine treatment. The fertility of treated *L. perenne* x *F. pratensis* hybrids was disappointing and this experiment will be repeated.

Anthoxanthum. A study of somatic chromosome morphology and pairing in the diploid collection indicates that the basic wild forms can be distinguished by the number and type of satellited chromosomes present. The self and cross fertility of the diploid perennial species *A. alpinum* ($2n = 10$), the diploid annual *A. puelii* ($2n = 10$), and the tetraploid perennial *A. odoratum* ($2n = 20$) were studied. Hybrids with *A. alpinum* were difficult to obtain but the other species crossed freely. The triploid hybrids of *A. puelii* x *A. odoratum* resembled the female parent irrespective of direction of cross. The self fertility of all three species was low. The polyploid *A. amarum* ($2n = 80$) was found to be self fertile. Seeds of *A. puelii* and *A. alpinum* were treated with colchicine to produce autotetraploids for comparison with *A. odoratum*; chromosome counts show that some plants have tetraploid ($2n = 20$) roots, and a few of the heads so far examined show the tetraploid number at meiosis. Fertile tetraploids have been produced from a sterile *A. alpinum* x *A. puelii* hybrid.

Holcus. Triploid hybrids of *H. lanatus* ($2n = 14$) x *H. mollis* ($2n = 28$) have been back crossed to both parents.

165 *Cooper, J. P. Plant genetics* (*grasses*). (*pp. 15–21*).

Screening for flowering response to low-temperature and short-day treatments was continued in a range of ryegrass material. All treatments revealed the same grouping of varieties, with no requirement in the summer annual Westerwolths, a quantitative response in the winter annual Wimmera, and an absolute requirement for cold or short days in most of the perennial varieties. A number of Mediterranean ecotypes of *Lolium perenne* and *L. rigidum* were also tested for response to low-temperature induction, and great variation was found within samples. Investigations into the genetic control of flowering response were continued; the data from single crosses and selfings of Irish and Kent ryegrass provided estimates of heritability of date of ear emergence of more than 0·8, indicating that most of the variation is additive. Response to selection continued in most lines, and genetic variation is still appreciable. There has been no apparent decrease in vigour although, in two lines, male and female sterility have appeared. The development and testing of nonflowering *L. perenne* material is still in progress; vigorous nonflowering plants have now been obtained in the third generation of selection for lateness in S23.

Further work on the photoperiodic requirements of *Phleum* varieties demonstrated the inhibitory effect of high temperature on flowering; the degree of tolerance in hexaploid varieties could be related to the May temperatures of their region of origin, the American and Canadian varieties being the most tolerant, and the Scandinavian, particularly the Finnish material, the least.

166 *Davis, W. E. Legume breeding (pp. 22–35)*

Lucerne. The inheritance of flower colour was studied in crosses involving violet, white and yellow-flowered plants representing lines from Ranger, Lucerne A, Grimm, Poitou, Rhizoma, du Puits, Ladak and *Medicago falcata* ($2n = 32$). Flower colour was found to be controlled by factors which were tetrasomically inherited. Segregation in the yellow x violet crosses was governed by complementary genes; in the other crosses it was inferred that one gene was responsible for the ratios obtained. The inheritance of chlorophyll deficiency was determined by a single gene inherited tetrasomically, and spotted leaves by two complementary genes. Selection for more than one cotyledon and also for two simple leaves increased the frequency of these types which appeared to be controlled by several genes. It is considered that "the evidence obtained is overwhelmingly in favour of tetrasomic inheritance and this suggests an autotetraploid origin for this plant."

Detailed morphological and cytological studies are being made on a number of perennial species and interspecific hybrids between them; embryological studies are also being made to ascertain why seed development is poor or does not occur in some crosses.

Clovers. Third-generation families of Ladino x S100 are now under study. A selection of late-flowering red clover without leaf markings and known as AA2 is being tested for persistency; selection Aa3305 is also being included in these tests. Crosses made between peaked plants of late-flowering red clover have given rise to some lines of highly uniform type as well as others segregating for a more prostrate growth habit. In trials of red and white polyploid clovers a number of lines have outyielded the diploid controls. White clovers from Europe and other parts of the world are being examined to determine their usefulness as breeding material. Studies on the genetics of V leaf marks in white clover were continued; combinations were produced of all the alleles at present available, *viz.* V^l, V^h, V^f, V^{ba}, V^b, V^{by} and V^p, and in most cases the heterozygotes could be readily identified. The V^{by} allele was partially dominant over all the others. Homozygous lines of all these markings are being produced. The inheritance of anthocyanin was also studied, but classification was difficult because the appearance of pigment in some lines is dependent on low temperature; this applies especially to the R^b (blotch) marking which is often associated with V^{by} leaf mark.

167 *Griffiths, D. J. Cereal, bean and Brassicae breeding. (pp. 36–49).*

Oats. Selections from crosses having Co4146 as the mildew-resistant parent have maintained their resistance through two seasons. Screening of selections for resistance to halo blight showed Cc4146 to be a better source of resistance to this disease than any previously reported; the inheritance of resistance is being studied in crosses of this selection with susceptible varieties. The F_3 progenies of crosses between stem-eelworm resistant selections and the mildew and crown-rust resistant line 4757/18/2/19 are being examined for genotypes conferring resistance to all three pathogens. The search for sources of resistance to *Heterodera major* in diploid, tetraploid and hexaploid *Avena* species was continued; on the basis of cyst counts the most promising sources appear to be forms belonging to the wild hexaploid species *A. sterilis* and the tetraploid *A. abyssinica.*

Cytological examination of fatuoids appearing in the X_3, X_4 and X_5 of irradiated *A. sterilis* var. *maxima* showed the fertile fatuoids to have 42 chromosomes and the sterile fatuoids only 40; heterozygous plants with 41 chromosomes were also found. Seeds were obtained from a few tillers of the triploid hybrid *A. abyssinica* x S171 after colchicine treatment. First generation plants of the derived 6*x* amphiploid from *A. abyssinica* x S75 included some individuals superior in fertility and showing better pairing at meiosis than any amphiploid progenies yet studied. The A_4 progenies of the 6*x* amphiploid from *A. abyssinica* x *A. brevis* showed poor adaptation to field conditions. All hybrids between 6*x* triploids and natural hexaploids have proved almost completely self sterile; hybrids between amphiploids however gave reasonably satisfactory seed sets. In contrast with the 6*x* amphiploid (shedding base) x *A. sativa* (nonshedding base) hybrids where nonshedding base was partially dominant over shedding base type, the hybrids from 6*x* amphiploid (shedding) x 6*x* amphiploid (nonshedding) exhibited complete dominance of shedding over nonshedding base.

Crosses between the tetraploid species *A. barbata*, *A. abyssinica* and *A. vaviloviana* revealed the presence of structural interchanges in some of the hybrids. In *A. barbata* x *A. abyssinica* hybrids an association of four chromosomes appeared in 15% of the cells, suggesting heterozygosity for a small interchange segment. *A. barbata* x *A. vaviloviana* hybrids showed one association in 54% of the cells and two associations in 18%, indicating two separate interchanges. Interspecific crosses between hexaploid species also revealed the presence of interchanges, and in *A. sterilis* the presence of multivalent associations was observed in crosses between types from different geographical regions.

Forage kales and rapes. A number of crosses were made to transfer clubroot resistance from a New Zealand variety to British rapes; the F_1 from such crosses shows a high degree of resistance, and segregation is clear cut in the F_2. Some promising plants have been obtained from crosses of kohl rabi with marrow-stem and Canson kales.

Field broad bean. The following hypothesis has been put forward to account for the type of self sterility encountered in the field bean: (1) the ancestor of the field bean was probably self incompatible; (2) the considerable selection pressure exerted towards uniformity (and hence inbreeding) is increased by the unreliability of insect pollination under British conditions; (3) a strong oppositional self-incompatibility system would be expected to break down at the pollen inhibition level, leaving a residual system comprising the entomophilous flowers and tripping mechanism, with the self-pollen inhibition being modified to one favouring cross pollination; (4) the many deleterious recessive genes accumulated by a self-incompatible organism would now restrict gene combination, particularly following selfing; (5) such a system of genes operating at the zygotic level could effectively take over the function of the original oppositional system and produce a new balanced mechanism of control at a lower level of hybridity; (6) this new balanced mechanism now appears to operate in field beans.

168 *Jones, K. Cytology. (pp. 69–71).*

Dactylis. An intensive analysis is being made of triploid hybrids from crosses between *D. glomerata* ($2n = 28$) and its diploid subspecies *woronowii*, *aschersoniana* and *lusitanica*, and between *D. maritima* ($2n = 28$) and the subspecies named. In the cross *D. glomerata* x ssp. *judaica* with the diploid subspecies as female parent, the analysis of six plants confirmed the lack of appreciable chromosome differentiation in *Dactylis*. Information is being collected on chromosome numbers and behaviour in progenies from triploid *Dactylis* hybrids crossed as females with diploid and tetraploid males.

Phleum. Chromosome counts on the open-pollinated progeny of a triploid plant of *P. nodosum* showed that most plants possessed the chromosome number of the pollen parents ($2n = 14$) while a few had $2n = 18$, or 19.

Phalaris. While the F_1 from *Ph. arundinacea* ($2n = 28$) x *Ph. tuberosa* ($2n = 28$) was only partially fertile, subsequent breeding has produced a highly fertile variety, S230. Chromosome counts showed the variety to be hexaploid ($2n = 42$) and it is therefore presumed that unreduced gametes have functioned at some stage in the breeding programme. The relatively high frequency of aneuploids (approx. 25%) in S230 is due to irregularities at meiosis.

Anthoxanthum. *A. amarum* was found to be 16-ploid with $2n = 80$. As reported earlier [cf. XXIX, 157] the tetraploid *A. odoratum* ($2n = 20$) is a permanent interchange heterozygote. The evidence suggests however that its permanent heterozygosity is due not so much to selection for favourable gene blocks as to polyploidy *per se*; it is thought that interchange pairing followed by chromosome doubling would produce the situation found in this species.

Alopecurus. *A. alpinus* was found to be 16-ploid with $2n = 112$.

***Holcus*.** To investigate the origin, relationship and taxonomic position of *H. lanatus* ($2n = 14$) and the races of *H. mollis* ($2n = 28, 35, 42$ and 49), two experiments were designed to measure their morphological characters together with those of the triploid hybrids from *H. lanatus* x *H. mollis* ($2n = 28$). The results, so far, confirm the lack of any good taxonomic character for separating the races of *H. mollis*, although the pentaploid seems to diverge in the direction of *H. lanatus* in certain vegetative features. Of three hybrid progenies examined, one was intermediate between the parents in vegetative characters, the second tended more towards *H. mollis* while the third closely resembled this parent. In spikelet characteristics the *H. mollis* features predominate in all crosses.

169 *Brief description of the new variety of winter oats, Penrhyn S.234. (pp. 76–77).* [Cf. XXIX, 3752].

170 Die 4. Festsitzung und Wissenschaftliche Tagung der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin. **(The 4th Celebration and Scientific Meeting of the German Academy of Agricultural Sciences in Berlin).**
Dtsch. Landw., Berl. 1959 : **10** : 564–70.

Papers presented by Wundsch and Becker have been summarized elsewhere [cf. XXX, 3682 and 3683].

Olschanski [Ol'šanskij] dealt with Grundlagen der materialistichen Entwicklung des Darwinismus [Basis of the materialistic development of Darwinism]; he outlined the principles of Mičurinism, showing how it differs from neodarwinism.

The subject of the paper by Wlassjuk [Vlasjuk] was Darwinismus und Pflanzen-physiologie [Darwinism and plant physiology]. The importance of comparative physiology is stressed; knowledge of physiology makes possible the creation of new organisms. Vegetative hybridization is thought to confirm Darwin's view that material used in the development of a new organism can occur in somatic tissue as well as in the sex cells and may be responsible for the occurrence of new characters. The influence of metabolism on the changes in organisms and in the inheritance of acquired characters is now being studied. The hypothesis that the gene is a DNA molecule is thought to be incorrect since the quantitative and qualitative composition of the nucleic acids is dependent on the conditions of culture and nutrition. Trace elements in particular influence the composition of nucleic acids.

171 Zusammenfassung 1958 und 1959 mehrjähriger Versuchsergebnisse von Getreide, Mais, Kartoffeln, Rüben, Luzerne, Rotklee. **(Summary of the results of several years' trials of cereals, maize, potatoes, beets, lucerne and red clover, 1958 and 1959).**
Bundesanst. Pflbau. Samenprüf., Wien 1959 : Pp. 32; 1960 : Pp. 36.

The results of varietal trials held at different centres in Austria are summarized in tabular form.

172 Zadražil, K.
Čočák—vikev s čočkoýitymi zrny jako jedlá luštěnina i jako pícnina. **("Čočák"—a vetch with lentil-like seeds as an edible legume and as a forage plant).**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 631–38.

"Čočák" plants were selected from weeds growing amongst lentils and are apparently the result of hybridization between lentils and vetches. They were found to be a suitable crop for regions where climatic and soil conditions are unfavourable to lentils. Types with light-green flat seeds like lentils have a cooking time of 46–48 min. and the uniformity of cooking is 96–99%; others with fuller, angular seeds and reddish or darkly coloured cotyledons have a cooking time of over 55 min. and 78–90% uniformity. Some types have strong stems and are more resistant to lodging; these are probably suitable for green forage. It may be possible to select against bitterness and hardness of the seed coat. This new vetch does not suffer as much as lentil from attack by *Fusarium* in the field and it also seems to be more resistant to *Peronospora lentis* and *Botrytis cinerea* but more susceptible to *Uromyces viciae*.

A cytogenetical analysis carried out by Sosna showed that this plant is not identical with lentil-vetch hybrids described in the literature; whereas these hybrids had a chromosome number of $2n = 12$, the new form has $2n = 14$. So far "Čočák" has not been crossed successfully with lentil.

Nemesített növényfajtákkal végzett országos fajtakísérletek eredményei 1958. **(Results of the national varietal trials of improved crop varieties, 1958).**
Budapest 1960 : Pp. 405.

173 *Jánossy, A. Az Országos Növényfajta-kísérleti Intézet 1958. évi munkája.* (*The work of the National Institute for Crop Variety Testing in 1958*). (*pp. 3–26*).

Notes are given on trials of cereals, potato, sunflower, flax, lupin, lucerne, lettuce and grape, carried out at the above Institute in Hungary. Among promising varieties are: the wheat Fertődi 293, the winter barley Gödöllő 52, the midseason potato Somogy 4 and the lettuce Soroksár [cf. XXX, 144]; the high-yielding early potato Sarga Kifli [Yellow Kidney], from Edelgard x Kifli; and the Gyulatanya yellow lupins, which flower a week earlier than other varieties and produce seed almost exclusively on the central axis, resulting in more uniform maturity.

174 *Sváb, J. & Wellisch, P. Szubjektiv fajtabírálat nagyüzemi kísérletekben; az értékelési módszer kiegészítése.* (*The subjective evaluation of varieties in farm-scale trials: a further development of the method of evaluation*). (*pp. 45–48*).

Further tables for estimating the value of a variety on the basis of the data obtained from questionnaires are presented [cf. XXX, 145].

175 *Hinfner, K. Cukorrépafajták* Cercospora-*rezisztencia vizsgálata és értékelese az 1958. évi országos kísérletekben.* (*Study and evaluation of* Cercospora *resistance in sugar-beet varieties in the 1958 national trials*). (*pp. 49–80*).

In trials of eight Hungarian and six introduced varieties at three stations in Hungary, the Hungarian BETA poli varieties 1, 2, 3 and 4 showed the greatest mean resistance and also the most consistent resistance to *C. beticola*, as determined from the degree of macroscopically visible leaf infection. Kleinwanzleben Cercopoly Einbeck was also highly and consistently resistant. Varietal differences in yields of tops could be attributed largely to differences in *Cercospora* infection. Varietal differences in infection increased markedly during the course of the vegetative period.

176 *Papp, Zs. Őszi búza* (Triticum aestivum *f.* hybernum *L.*). [*Winter wheat* (T. aestivum *f.* hybernum *L.*)]. (*pp. 81–94*).

Data on maturity period, yield, tillering, number and weight of grains per ear, 1000-grain weight and quality are given for 13 varieties tested at various stations in Hungary in 1957–58. Incidence of lodging, rust, smut and shattering in 1958 is also indicated. The rust-resistant variety Fertőd 293, which is fairly tolerant of drought, gave the highest yield in 21 out of 23 trials. Among new varieties, Karcag 522 was productive and reliable in yield.

177 *Papp, Zs. Rozs* (Secale cereale *L.*). [*Rye* (S. cereale *L.*)]. (*pp. 95–111*).

On the basis of data on straw yield, grain yield, resistance to lodging and rust, protein content and growth period in the land-race derivatives Lovászpatona, Fleischmann and Óvár and the Petkus derivatives Kisvárda and Kecskemét, tested in 1954–58, recommendations regarding the most suitable varieties for different regions of Hungary are made.

178 *Kelemen, I. Őszi zab* (Avena sativa *L. var.* hybernum). [*Winter oats* (A. sativa *L. var.* hybernum)]. (*pp. 113–31*).

Among six varieties tested at various stations from 1955–56 to 1957–58, H–9 was the most reliable yielder, followed by Szarvasi Suverain and Karcag. Frost resistance was not high in any variety. Tables showing yield, grain characteristics, stand density, degree of shattering, lodging and frost damage and quality are included.

179 *Kelemen, I. Tavaszi zab* (Avena sativa *L.*). [*Spring oats* (A. sativa *L.*)]. (*pp. 133–53*).

In trials of 10 varieties in 1956–58, Universal, Flämmingstreu Original, Udycz Żołty [Udycz Yellow] and Kompolt were the most productive. Data on yield, lodging, quality and other characters are presented in tables.

180 *Horváth, P. Rizs* (Oryza sativa *L.*). [*Rice* (O. sativa *L.*)]. (*pp. 155–81*).

Figures for yield, 1000-grain weight, hl.-weight, degree of lodging and shattering, incidence of blast and hulling percentage are given for varieties tested during 1955–58. Ömirt 39 was one of the best varieties but was suceptible to blast, while the high-yielding varieties Linea 45 and Precoce Allorio [Allorio Early] were late in maturing.

181 *Kapás, S. Kukorica* (Zea mays *L.*). [*Maize* (Z. mays *L.*)]. (*pp. 183–97*).

Tables giving data on the performance of various new midseason and early varieties compared with established varieties are presented, together with diagrams showing the relationship between male flowering date and yield for each variety. Ajtai, Iregi ZI and Kaszapovics were the best new varieties but yielded less than earlier-ripening interline hybrids or the state certified variety Szegedi sárga [Szeged Yellow].

182 *Schüller, F. 1958. évi nagyüzemi hibridkukorica-kísérletek.* (*Farm-scale trials of maize hybrids in 1958*). (*pp. 199–234*).
As in previous years [cf. XXVIII, 2616 and XXX, 151], Mv5 proved to be the most widely adapted of the Hungarian and introduced hybrids tested in full-scale farm trials throughout the country.

183 *Kiss, T. Cukorrépa* (Beta vulgaris *var.* saccharifera *Alef.*). [*Sugar beet* (B. vulgaris *var.* saccharifera *Alef.*)]. (*pp. 235–54*).
In tests of Hungarian and introduced varieties at various stations, the triploid BETA poli varieties were again superior to others in yield of sugar and resistance to *Cercospora* [cf. XXVIII, 2617].

184 *Kiss, T. Takarmányrépa* (Beta vulgaris *var.* crassa *Alef.*). [*Mangel* (B. vulgaris *var.* crassa *Alef.*)]. (*pp. 255–75*).
In tests of Hungarian and introduced varieties conducted during 1956–58, the new BETA triploids K331, K524 and TK523 surpassed all other varieties in dry-matter yield, K331 being best, with a root yield equal to those of the diploid Rózsaszínű BETA [Rose-coloured BETA] and a dry-matter content equal to that of Bábolnai sárga henger [Bábolna Yellow Cylindrical]. The diploid sugar mangel BETA 436 has also given very good yields of dry matter and is a useful breeding parent.

185 *Bakos, Zs. Kender* (Cannabis sativa *L.*). [*Hemp* (C. sativa *L.*)]. (*pp. 277–303*).
Data on the yield and quality of hemp varieties and hybrids tested at six stations during 1955–58 are presented. The hybrids, particularly Fertőd, were more rapid in emergence and more vigorous in early growth than the varieties, and were generally taller and earlier. All the hybrids were from crosses between Chinese female parents and Hungarian pollen parents. Among the hybrids, KH571 was higher in straw yield than Fertőd or B7 but Fertőd was best in quality.

186 *Kelemen, I. Takarmánykáposzta* (Brassica oleracea *var.* acephala *DC.*). [*Fodder kale* (B. oleracea *var.* acephala *DC.*)]. (*pp. 305–12*).
In tests conducted at three stations in 1957 and 1958, Óvári vastagtörzsu magas [Óvár Thick-stemmed Tall], developed by individual selection from a mixture of English and German marrow-stem kales, outyielded a commercial variety in both years and also a kale included only in the 1958 tests.

187 *Komjáti, I. Fűszerpaprika* (Capsicum annuum *L. var.* longum *DC.*). [*Red pepper for condiment* (C. annuum *L. var.* longum *DC.*)]. (*pp. 313–37*).
On the basis of further trials conducted in 1955–57, the nonpungent varieties Szegedi nem csípős 47–25 [Szeged Nonpungent 47–25], Dokomlási nem csípős 2710 and Kalocsai E15 and the pungent variety Szegedi 48–163 are recommended for state certification [cf. XXVII, 2606]. F03 shows promise on account of its high pigment content.

188 *Komjáti, I. Bokorbab* (Phaseolus vulgaris *L. var.* nanus *Mart.*). [*Dwarf bean* (Ph. vulgaris *L. var.* nanus *Mart.*)]. (*pp. 339–70*).
The results of varietal trials carried out at various stations in 1956–57 are reported. Among 12 yellow-podded varieties, the Budatétény strain of Aranyeső [Golden Rain] gave the most consistently high yields; the German variety Quitlinga was good in yield and canning quality and Törékeny viasz [Brittle Wax] was high in quality although not in yield. Four green-podded beans were tested, of which Saxa and Wisconsin were both good in quality. Of 17 dried-bean varieties, Tétényi gyöngybab [Tétény Pearl bean] and Keszthelyi ólombab [Keszthely Leaden bean] gave the highest yields; both are developed from the commonly grown land race Cukorbab [Sugar bean] and the second requires a shorter cooking time than the first. Protein percentage was highest in the large-seeded type Fertődi fehér [Fertőd White].

189 *Tomcsányi, P. Fás növények fajtaértékvizsgálatának rendszere, különös tekintettel a gyümölcsfákra.* (*Általános módszertani előírás*). [*A system for the examination of varietal value in woody plants, with special reference to fruit trees.* (*General methodological rules*)]. (*pp. 371–402*).
The previously described method of determining varietal value from the three components yield, market price and cost of production is further elaborated [cf. XXVII, 2611], detailed suggestions being made for the estimation of yield in particular.

190 Estación Experimental de Aula Dei. Departamento de mejora. Ensayos 1958–1959. (**Experimental Station of Aula Dei. Department of Breeding. Trials, 1958-1959**). Pp. 16. (Mimeographed).
Further investigations on the following crops are reported [cf. XXIX, 3512].

Wheat. The selection MM–4 has continued to show favourable results on unirrigated land. Now named Toroma, it is currently undergoing multiplication. For irrigated conditions, the selection H–11, named San Bruno, is being multiplied.

Oats. Cartuja is recommended for both dry and irrigated land.

Barley. The variety recommended for dry conditions, Albacete I, is now being multiplied on a commercial scale. Ricla 2a has proved superior to other selections under irrigated conditions.

Vetch. The selections VM–43, VM–46, VM–46, VM–5, VM–21, VM–38 and VM–28 all showed greater resistance to cold than the controls *Vicia villosa* and commercial *V. sativa.* The first two selections also gave significantly higher herbage yields.

Sugar beet. Triploid and tetraploid varieties gave promising results in a series of trials comparing 23 Spanish and introduced varieties.

191 SINSKAJA, E. N. & BORKOVSKAJA, V. A. (**Methods of analysing plant populations**).
Bjull. Mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.) : Otdel biol. (Biol. Ser.) 1960 : **65** : 77–88. [Russian].

For studying the composition of a population of a variety or ecotype in such plants as wheat, oat, rye, barley or *Lallemantia*, the following methods are recommended: (1) growing the population in diverse cultural or ecological environments; (2) subjecting it to varied vernalization or photoperiodic treatments; and (3) growing in a new set of external conditions, for which natural selection could not have previously been operative, e.g. continuous day or constantly high temperature. All populations of plants, whether they have a winter, spring or alternative habit, are said to comprise several physiological biotypes.

192 POLJAKOV, I. M.
[**The oldest breeding and research institute in the Ukraine. (On the occasion of the fiftieth anniversary of foundation of the Har'kov breeding station, now known as the Scientific Research Institute of Plant Industry, Breeding and Genetics)**].
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 50–54. [Russian].

This survey of genetical studies and the breeding of wheat, oat, rye, barley, maize, vetch, sunflower, soya bean and other crop plants mentions the hard wheat Har'kov 46 which was obtained by interspecific hybridization involving *Triticum durum*, *T. turgidum* and *T. dicoccum.* The hybrid is interesting for its grain quality and high yield.

Jord—Gröda—Djur. Aktuella praktiska resultat från svensk jordbruksforskning. Årsbok 1959. (**Soil—Crops—Animals. Current practical results in Swedish agricultural research. Yearbook 1959**). Pp. 294.

193 *Tedin, O. Förädling av potatis.* (*Potato breeding*). (*pp. 47–51*).

This popular article on potato breeding outlines the procedures involved in developing a new variety with good tuber shape and quality and refers to sources of disease resistance among wild and cultivated potatoes.

194 *Nilsson, H. E. Om stråbassjukdomar och hur de motarbetas.* (*On foot-rot diseases and how they are controlled*). (*pp. 68–77*).

A table showing the degree of resistance of 11 winter and 12 spring wheats to take-all and eye spot and a discussion of breeding for resistance to these disorders are included. Marked differences in resistance have been found among varieties and also among 56-chromosome rye-wheat hybrids. Breeding is rendered difficult by the fact that each disorder can be caused by more than one pathogen and the mechanism of resistance is complicated.

195 *Nilsson, F. Nya sorter av bärväxter.* (*New varieties of small fruits*). (*pp. 115–20*).

A survey of recent European varieties of strawberry, raspberry, blackberry, black currant, red currant and gooseberry is presented.

196 Pajbjergfondens Forædlingsvirksomhed 1920 - 1. Maj - 1960. (**The plant breeding work of the Pajbjerg Foundation. 1 May, 1920 - 1 May, 1960**). Pp. 56.

In this survey of results obtained at the Pajbjerg Foundation, Denmark, during 1920–60, the following recent work is described, in addition to investigations on wheat, barley, grasses, clover and beet already abstracted [XXX, 166].

Grasses. Characters which will ensure high yields without depressing the growth of clover in grass/clover mixtures are being investigated in different species. Tetraploids are also being studied.

Lupin. Nonshattering material has been obtained from crosses of Rex with German nonshattering lupins. A form of Rex with rapid early growth preventing the development of weeds has been developed from crosses with German and Netherlands varieties with this character.

197 SALZMANN, R.
Tätigkeitsbericht der Eidg. Landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon über das Jahr 1958. (**Report of the work of the Federal Agricultural Research Station Zürich-Oerlikon for the year 1958**).
Landw. Jb. Schweiz 1959 : **8** : 659–733.

The breeding of cereals and forage plants has continued, special attention being given to the improvement of disease resistance. Varietal trials were carried out with cereal, forage, root and oil crops.

198 Stations Fédérales d'Essais Agricoles, Lausanne. Rapport d'activité 1958. (**Federal Agricultural Research Stations, Lausanne. Report of activity, 1958**).
Landw. Jb. Schweiz 1959 : **8** : 439–657.

In addition to the work mentioned below, variety trials of cereals, forage plants, root crops, fruit and vegetables are reported [cf. XXIX, 2312].

Wheat. A large number of crosses involving local and foreign varieties are reported. The breeding of lines with resistance to black rust and *Septoria* rot is being continued. Certain lines of *Triticale* have proved to be very resistant to lodging. The F_1 and F_2 of *Aegilotricum dicoccoides—squarrosa* x cultivated varieties show high fertility but most intergeneric crosses involving *Aegilops* and *Triticum* were partially, or completely, sterile.

Rye. Studies have continued on the tetraploid variety Rothenbrunnen.

Barley. Of the spring tetraploid varieties created in past years, only two varieties, Isaria and Ceresia, are being multiplied; the fertility in both is satisfactory.

Maize. Hybrids derived from crosses between Swiss and American varieties have proved to be higher yielding, as well as more resistant to cold and lodging, than pure American varieties.

199 PRÉVOT, P.
Recherches agronomiques sur les oléagineux tropicaux. (**Agronomic research on tropical oil plants**).
Oléagineux 1960 : **15** : 449–60.

Investigations conducted in various African states by the Institute for Research in Oil and Oil Plants are reported.

Cacao. Improvement work is still in the early stages, but breeding nurseries have been established at La Mé and at Semé-Podji, Dahomey. Amongst the various foreign and indigenous types involved in breeding is dwarf cacao; the cross between dwarf and normal cacao is both early and high-yielding.

Castor oil. In South Dahomey, the selection of a local variety which can be harvested mechanically and is capable of yielding 1500 kg./ha. is reported. Using back-cross techniques, further hybridization work is continuing.

Oil palm. Breeding work at the branch stations of the institute is described. One line has been selected at La Mé, Ivory Coast, which has yielded over a 5-year-period an average of 3·3 tons of oil per ha., as compared with a yield of 200–300 kg./ha. from unimproved palms. It is predicted that by 1968 seed stocks with a guaranteed yield potential of 3½ metric tons/ha. will be generally available.

Groundnut. In French Congo, 3-grained edible forms have been selected which yield 2 metric tons of pods per ha. from October to February and a further 1½ tons/ha. between February and May. Hybridization programmes to produce commercial 2-grained varieties are also under way. Varieties resistant to rosette disease and capable of yielding up to 1800 kg./ha. have been selected at the Upper Volta station, where wild Brazilian species as well as local and introduced varieties are incorporated into the breeding programme.

200 Rapport Annuel pour l'exercice 1958. (**Annual Report for the financial year 1958**).
Publ. Inst. nat. agron. Congo belge 1959 : Pp. 529.

In addition to the results summarized below, breeding of cereals, forage grasses, potato, sweet potato, yam, bean, pea, *Vigna*, tobacco, tea, sugar cane, citrus and other fruits and other minor crops are briefly reported. Variety trials of all crops were held at various centres throughout the Congo.

Maize. Breeding for earliness was continued and a number of promising lines have been selected from GPS2 x Gemena.

Rice. Lines RE248 and RE342 are being used to improve vitreousness and lodging resistance in R20, OS6 and RE352. In *Oryza perennis*, *O. sativa* var. *fatua* and *O. officinalis*, $2n = 24$. Microsporogenesis was regular and pollen grains were viable in the wild species *O. barthii*, which produces no seeds. Meiosis was similar in the two natural tetraploid species *O. schweinfurthiana* and *O. latifolia*; secondary associations were frequent at diacinesis and quadrivalents were found in many sporocytes. Observations on the ovules of diploid and tetraploid R66 plants showed fertilization to be less frequent in the tetraploids. Colchicine-induced tetraploids have been produced from OS6.

Leguminous crops. Chromosome numbers reported are: *Crotalaria anagyroides*, *C. retusa*, *C. intermedia*, *C. spectabilis* and *C. axillaris*, $2n = 16$. Colchicine-induced tetraploids of *C. longithyrsa* var. *latifolia* are distinguishable by the dark green colour and large size of the leaflets and the increase in stoma and flower size. The flowers are sterile.

Cotton. Lines NC7/2613, NC8/2673 and ND3/2040 are high-yielding selections with good fibre length. NC8/2673 is particularly promising, being adapted to a wide range of conditions and resistant to *Xanthomonas*, *Fusarium*, *Lygus* and jassids.

Brief notes are given on interspecific crosses made to increase drought and disease resistance and to improve fibre characteristics in the Upland cotton C2, and involving *Gossypium raimondii*, *G. thurberi*, *G. sturtii* and *G. anomalum*. Some resistance to *Paurocephala gossypii* was found in Upland x *G. sturtii* plants but these were heavily attacked by jassids. Upland x *G. anomalum* plants were resistant to jassids.

Cassava. Breeding for resistance to mosaic and root rot diseases is in progress.

Coffee. Preliminary observations suggest that *Coffea lebruniana* is self fertile. A colchicine-induced tetraploid of *C. robusta* has been crossed with *C. arabica*. Notes are given on the following crosses: *C. canephora* x *C. congensis*, *C. liberica* x *C. robusta*, and *C. robusta* x hybrid Kawisari. The triploid nature of 28 *C. arabica* x *C. eugenioides* clones is confirmed; some meiotic abnormalities were noted. Colchicine-induced tetraploids of *C. canephora* have a pollen-grain diameter of 35 μ compared with 24 μ in the diploids, and 177 stomata per mm.^{2} compared with 354. The tetraploids are being selfed and cross pollinated by *C. arabica*.

Cacao. Studies on autosterility were continued. No differences were observed in the germinative ability of pollen grains from self-fertile and self-sterile clones and no inhibition was found in the stigma or style in the latter. In self-sterile clones a zygote was formed in only a little over one half of the ovules, the parent nuclei remaining side by side in the others. In those ovules containing a zygote nucleus the polar nuclei were frequently not fertilized. Rarely an unfertilized oosphere with a triploid endosperm was observed.

Oil Palm. Studies on fruit colour inheritance showed the *virescens* character to be controlled by a single incompletely dominant gene. The presence in *virescens* types of a range of colour from pale green to dark blackish green is believed to be due to a series of modifying *nigrescens* genes. Three lines of (*Elaeis melanococca* x *E. guineensis*) x *E. guineensis* origin are short stemmed, have fruits of the *E. guineensis* type and have given above-average yields.

Rubber. The superiority of clone Y3/46 on heavy clay soils has been confirmed. Microsporogenesis was studied in *Hevea guyanensis*, *H. collina*, *H. benthamiana*, *H. spruceana* and *H. brasiliensis*. Some quadrivalents were observed at diacinesis in all species, generally one per sporocyte but occasionally two or three. Apart from some abnormalities noted in one *H. guyanensis* plant, meiosis was regular. In all species four of the 36 chromosomes bear satellites.

Pyrethrum. Pollen grain and stoma measurements have been used successfully to separate diploids, triploids and tetraploids.

Groundnut. The varieties AE42 and AE14 easily outyielded the standard variety A65, and the white-kerneled varieties A9, E66, Malunguna, Kitunga, Bombi and A20 have equalled the latter. A semierect variety, P43, which has kernels of high average weight is being distributed in the central forest region.

Banana. From a series of crosses made to produce a parthenocarpic banana with the organoleptic characters of plantains and the suckering habit of edible bananas, a number of vigorous hybrids have been obtained. Three triploid hybrids exhibiting plantain characters were isolated from back-cross progenies. With the aim of producing triploid clones combining *Musa balbisiana* and *M. acuminata* genomes a number of crosses between tetraploid and diploid species were made. Populations under observation include three triploids from (Argent x *M. acuminata*) x *M. acuminata*, thirteen diploids from (Km5 x *M. acuminata*) x (Argent x *M. acuminata*), and eleven tetraploids from back crosses of *M. acuminata* x *M. ornata* with one or the other of the parents.

Distinct ecotypes, differing in important stem characters and particularly in the number of bunches per stem, were noted in the varieties Ifelete and Libanga likale.

201 MARIANI, G.
Considerazioni su problemi di sperimentazione agraria e di miglioramento genetico in Somalia. (**Considerations on problems of agricultural experimentation and genetic improvement in Somaliland**).
Riv. Agric. subtrop. 1960 : **54** : 517–34.

An outline is given of the work done during the period of Italian administration on the improvement of agriculture in Somaliland, with some considerations for the future.

Under the heading of plant breeding it is pointed out that repeated introductions of yellow dent maize in the last few decades have led to genetic admixture to such an extent that it is no longer possible to find the original type, which was a white flint, in a pure state. In view of the varied climatic and other conditions it is thought that synthetic varieties are more likely to prove promising than are double-cross hybrids, except in the very best farms.

202 **Agricultural experiment station, Salisbury. Results of experiments: season 1958-1959.**
Rhod. agric. J. 1960 : **57** : 231–43.

Wheat. A selection from a cross between Federation and an Angolan variety outyielded the standard variety Punjab 8A. F260A1, developed from a New Zealand hybrid, also yielded well. Of nine varieties tested for baking quality, a Lee x Selkirk hybrid was best.

Maize. A new line, SR hybrid No. 12, matures a few days earlier than Hickory King and is more resistant to *Helminthosporium turcicum* (*Trichometasphaeria turcica*). Two single-cross hybrids, 58H2 and 58H3, are early-maturing lines which have yielded well in different parts of the country. 58H6, the pollen parent of SR Hybrid 12, has continued to give high yields. A back-crossing programme designed to improve leaf-blight resistance in the inbred line A–5–7–6 was continued, but it is now considered doubtful whether the recovered line will be appreciably superior in resistance. Yield trials of various experimental and commercial hybrids are reported.

Potato. In trials of introduced varieties, South African lines R571/1 and R639/33 showed good resistance to blight and should provide useful breeding material.

203 **Annual Report of the Minister of Agriculture for Canada for the year ended March 31, 1959** : Pp. 158.

New varieties of cereals and other crops already referred to in *Plant Breeding Abstracts* are omitted from mention in the following abstract.

DNA synthesis. Sulphydryls have been found to influence the course of DNA synthesis [cf. XXVIII, 3765]. In addition, "by use of appropriate poisons it has been possible to arrest chromosome duplication and to show that as a consequence of this arrest the building blocks of DNA accumulate" [cf. XXIX, 1228].

Microbial genetics. Study of spontaneous mutations affecting pathogenicity of *Xanthomonas phaseoli* continued. A mutant of this organism requiring streptomycin for growth will, it is hoped, be of use in screening for chemical mutagenesis. Further investigations have been carried out on the pathogenicity of mutants of *X. phaseoli* requiring aminoacids or water-soluble vitamins. Symptoms of blight ranging from severe to absent were obtained. Unexpectedly, different mutants requiring the same growth factor produced symptoms of different degrees of severity; apparently pathogenicity does not depend solely on the simple availability or otherwise of growth factors.

Wheat. Genetic information has been obtained on (1) stem solidity in relation to resistance to *Cephus cinctus*, (2) leaf-rust resistance in Selkirk, Exchange, Lee, Gabo and Timstein, (3) dwarfing in Redman, and (4) seed dormancy and pericarp colour.

Oats. New selections with the Landhafer and Victoria genes for crown-rust resistance and Garry type of stem-rust resistance are under test. Search for sources of resistance to the new stem-rust races 8A and 13A continued. At Winnipeg resistance to these races was obtained from a sister strain of Vanguard. This new type of resistance is apparently effective against all other known races of stem rust.

Maize. Five early-maturing, yellow dent hybrids developed at Ottawa have been licensed as Canbred 256, 263, 267, 268 and 271. Several hybrids were produced at Ottawa by crossing a ♂-sterile single cross with a pollen-restorer single cross in which two restorer lines were used; 100% pollen restoration was secured in the double hybrid.

Barley. With a view to extending the area of cultivation of winter barley, at present confined to southern Ontario and coastal areas in British Columbia, breeding is in progress to combine the winter hardiness of related *Hordeum* spp. with desirable commercial characteristics. Jet has been used almost exclusively as a source of loose-smut resistance but resistance derived from this variety will not afford indefinite protection. The following are among the recent introductions also found to be resistant: CI1296–1, CI3951–3, CI5798, Nigrinudum and a mutant from Valki. The relationship of the genes carried by these barleys to the Jet gene is under investigation at Brandon, Man. Varieties highly resistant to scald have been found. Infection occurs most readily with high humidity and a temperature of about 50° F.; deviation from these conditions apparently accounted for the variable reaction of a variety in different tests.

Lucerne. In Alberta, yellow-flowered strains were highly resistant to winter crown rot and several other new selections exhibited a promising degree of resistance. The creeping type of growth may be detected in young plants by chemical assay of growth hormones. Selection for this character may therefore be made at an early stage. Resistance to *Meloidogyne* spp. is due to dominant genes inherited tetrasomically. A "Bacto-agar" culture method has been developed to facilitate selection of nematode-resistant seedlings.

Swede. Hybrids highly resistant to clubroot have been developed at Nappan, NS.

Potato. A hybrid from a cross between Epicure and a wild South American species was highly resistant to isolates of potato virus F. Varietal differences in tolerance of Mn toxicity have been found in the field and liquid culture. A wild potato (unspecified) highly resistant to common scab has not been used by breeders on account of its otherwise undesirable characters. Breeding material with the scab resistance of this wild species but lacking its most undesirable features has however been developed in New Brunswick.

Flax. Several rust-resistant lines from Redwing x Rocket exceeded the susceptible parent in yield in preliminary trials in Alberta. A study using growth cabinets was initiated to determine why Raja matures much later than Redwing in northern areas but not in southern ones. The development of Raja underwent more hastening that that of Redwing in response to red radiation and, to attain an equal stage of maturity, Raja required a higher temperature for flowering than Redwing. Other varieties have also varied in response to red light and temperature.

Tobacco. Varietal tolerance of weather fleck is being determined in flue-cured tobacco in Ontario. Delcrest has shown least susceptibility. Progress has been made in developing Burley strains resistant to etch virus and cigar selections resistant to black root rot and low in alkaloid content.

Safflower. As a result of selection of world-wide introductions and by hybridization at Ottawa, a few high-yielding lines are now available for further testing. Investigations on inbreeding have so far indicated that safflower depends on cross pollination for high yield.

Apple. Cortland, Delicious, Haralson, Lawfam, Linda, Lobo, McIntosh, Melba, Northern Spy, Sandow and Yellow Newton were studied with respect to ability to transmit any of 12 important characteristics to their progenies.

Strawberry. In a study of the value of inbreeding, six of the inbred clones tested were superior to the original varieties in ability to transmit desirable characteristics to their progenies and will replace the latter in breeding. Seedlings of a native strawberry (unspecified) collected in Chile were tested for *Verticillium*-wilt resistance. Resistant plants occurred in three of eight collections and tolerant plants in all but one. It is suggested that the resistance in certain cultivated varieties may have been introduced through this wild strawberry, which occurs in North and South America, and that by selfing these varieties resistant lines may be isolated.

Tomato. High-yielding seedlings homozygous for *Verticillium*-wilt resistance have been developed at Summerland, BC. Breeding at Kentville, NS, has resulted in selections with a high degree of late-blight resistance and desirable horticultural features.

Field pea. Similar to Chancellor in time of maturity and to this variety and Arthur in commercial cooking tests, 3884A [(Chancellor x Raymond) x Stirling] is being increased. It ripens two days earlier than Arthur and has outyielded commercial varieties.

204 **Annual Report of the Minister of Agriculture for Canada for the year ended March 31, 1960** : Pp. 51.

This is the first report of the Canada Department of Agriculture in its present form, a new plan of departmental organization having been introduced in 1959. The report is confined to giving only a broad account of the various activities, including the objectives and progress of crop breeding and other work carried out by the Research Branch.

205 van Emden, J. H.
Jaarverslag 1958. Landbouwproefstation, Suriname. (**Annual Report, 1958. Agricultural Experimental Station, Surinam**). 1959 : No. 21 : Pp. 88.

Besides the work referred to below, trials of coffee, groundnut, *Citrus* rootstocks, cowpea and Lima beans are in progress.

Rice. Milla Grosa, Ambemohde 15 and Ambemohde 157, which have many grains per panicle, have been crossed with (*a*) large-grained lines good in quality though not in productivity and (*b*) Holland 5023, Dima and Krakti. Lines developed in previous years have been crossed with Holland 5023 for the production of material which shows rapid early growth and is easily transplanted; in the F_1 the robust growth of Holland 5023 was dominant. In breeding for resistance to hoja blanca [white leaf], Lacrosse has been crossed with Skrivimankoti Dima, Holland 5023 and large-grained, lines (K8–C) from Géant [Giant] x Dima. F_1 plants from Lacrosse x K8–C had larger kernels than the mother plants. Lines from the populations K12, K13 and K14, characterized by a high proportion of plants with smooth leaves and hyaline grains, have been selected.

Oil palm. Four groups of material, two of Deli *dura* origin, one from crosses and selfings of *dura* x *dura* and *tenera* x *tenera* and one from *dura* x *pisifera*, are under observation for the purpose of selecting good *dura* mother trees.

Soya bean. Characters found among selections from the X_5 of X-irradiated material of Vada and the black-seeded variety Laris include a vigorous main stem with large leaves, large, white-seeded pods with few hairs, and large seeds.

206 Santiago, A.
Controlled evolution of breeding systems in perennial tropical crops.
Proc. Centenary Bicentenary Congr. Biol. Singapore 1958 : 326–33.

Breeding methods in *Elaeis*, *Carica*, *Citrus*, *Musa* and *Saccharum* are discussed, particular attention being paid to the criteria used in selection and to the characteristics of each genus tending to facilitate or retard genetic improvement. It is pointed out that an understanding of controlled evolutionary trends will minimize labour and expenditure involved in breeding these crops.

Attention is drawn to the current tendency to neglect the preservation and perpetuation of wild species carrying genes of possible value; the author recommends the establishment of collections of cultivated varieties of plants together with their wild allies.

207 **Plant breeders' rights. Report of the Committee on Transactions in Seeds.**
HM Stationery Office 1960 : Pp. 121.

The report on plant breeders' rights in the United Kingdom, made by the Committee on Transactions in Seeds, is given. It contains chapters on: breeding new varieties; breeding in the United Kingdom; breeding and breeders' rights overseas; general principles involved in the encouragement of breeding; methods of encouraging private breeding; definition and scope of the breeder's rights; exercise and safeguards of rights; conditions for the grant of rights; requirements and procedure for applications; application of proposals with respect to particular groups of plants; administration; appeals and proceedings for infringement; and general conclusions. A summary of the detailed recommendations and appendices giving miscellaneous information complete the report.

208 Stuke, H.
Über den Einsatz des Frontmähers in der Pflanzenzüchtung. **(The use of the front mower in plant breeding).**
Z. landw. Vers.-UntersuchWes. 1960 : **6** : 263–74.

A small-scale mower suitable for mowing experimental plots 1·20 m. broad has been designed at the plant breeding institute at Hohenthurm and is described and illustrated.

209 Kraai, A.
Het gebruik van isolatieruimten in de praktijk. **(The use of isolation chambers in practice).**
Zaadbelangen 1960 : **14** : 93–94.

Various types of isolation chamber used in the Netherlands are described.

210 Bálint, A. & Kovács, G. (Mrs.)
A heterózis genetikai és fiziológiai alapjainak tanulmányozása a növényvilágban P^{32} felhasználásával. **(Studies in plants on the genetical and physiological bases of heterosis, using P^{32}).**
Növénytermelés 1960 : **9** : 15–26.

In a comparative study of the growth and development of maize inbreds and hybrids, greater differences were found between the inbreds and their single crosses than between the single crosses and their double hybrid, Mv5. Preliminary analysis revealed no consistent difference between parents and hybrids in respect of the phosphorus content, expressed as a percentage of the dry weight, of the pollen grains, pistils, ears and embryos, although the hybrids were sometimes superior. Experiments with P^{32} showed appreciably higher P contents in 10-day old embryos from certain crosses than in those from selfings. A similar superiority of hybrids over selfed material was observed for P^{32} content in the leaves and flowers of the tomato varieties Kecskemét 42 and Kecskeméti törpe [Kecskemét Dwarf] when selfed and crossed with one another.

211 Remussi, C.
Mutaciones inducidas por la aplicación de rayos X. (**Mutations induced by the application of X rays.**)
Rev. argent. Agron. 1959 : **26** : 108–09.

The results are presented of some preliminary experiments on the irradiation of seeds of sunflower, flax and poppy. One line of sunflower was produced which flowered 30 days before the remainder of the plants.

212 Davies, D. R.
Induced mutations in crop plants.
J. R. Soc. Arts 1960 : **108** : 596–611.

The text is given of the Fernhurst lecture delivered to the Royal Society of Arts, England, on 16 March 1960. An examination of irradiation and chemical techniques is followed by an assessment of the results so far achieved in various countries, with suggestions as to future lines of research. The general conclusion is reached that at present induction of variability by mutagens offers no advantages over hybridization except in certain cases, e.g. some loss mutations for induction of self fertility in cherries, mutagen treatment of asexually propagated plants, and chromosome breakage to eliminate undesirable linkages. Radiations and mutagenic chemicals may also prove useful in overcoming barriers to wide crossing. In this connexion, the value of ionizing radiations is being studied intensively at Wantage Radiation Laboratory.

213 Reyntens, H. & Loose, R. de
Radiations ionisantes et mutations au service de l'amélioration des plantes. (**Ionizing radiations and mutations in the service of plant improvement**).
Rev. Agric., Brux. 1960 : **13** : 183–89.

The following are discussed: ionizing radiations; mechanism of interaction between ionizing radiations and biological tissue; principles of irradiation; and results. The last consists of a short historical account of the production, using these methods, of useful mutations in crop plants.

214 Morrison, J. W. & Rajhathy, T.
Chromosome behaviour in autotetraploid cereals and grasses.
Chromosoma 1960 : **11** : 297–309.

Four induced autotetraploid cereals, wheat, oats, barley and rye, and two natural tetraploid grasses, *Hordeum bulbosum* and *Arrhenatherum elatius*, were investigated. In all cases chiasma frequency of autotetraploids was less than twice that of corresponding diploids. No correlation between chiasma frequency and the number of quadrivalents was found. In tetraploid flax and maize, with small chromosomes, over 70% of the chromosomes formed quadrivalents, whereas in the grasses and cereals studied about 60% of the chromosomes were associated as multivalents. Environment did not have a significant effect on chromosome association. No differences in pairing behaviour were found within species except in the case of *H. bulbosum*. The six cereals and grasses had a mean of 4·3 quadrivalents per cell, there being no great differences between natural and artificial autotetraploids in this respect, and none of the autotetraploids showed a trend towards bivalent formation. The species differed in respect of the amount of seed set. Plants of *Triticum monococcum* with high and low fertility were selected. Quadrivalent formation was not related to fertility and it is concluded that genetical control and the environment have more effect on fertility than meiotic irregularities.

215 Hahn, P.
Neuzulassungen landwirtschaftlicher Kulturpflanzensorten 1959. (**Recent admissions of varieties of agricultural cultivated plants, 1959**).
Dtsch. Landw., Berl. 1959 : **10** : 577–78.

Barley. Ceres is a six-rowed spring barley with particularly good standing capacity and suitable for combine harvesting. It is only recommended for good soils well supplied with water. Its 1000-grain weight is medium to high and the crude protein content average. The grain is suitable for fodder but not for malting.
Rye. Gülzow is a winter variety of average 1000-grain weight and average protein content. On light soils it has yielded as well as Petkus and Norddeutscher Champagne [North German Champagne] and in high altitudes it has produced more grain.
Lupin. The seed of Neutra, a variety of *Lupinus albus*, makes valuable fodder, the protein content being about 36% and the fat content 11%. Neutra ripens about seven days earlier than Nährquell and has better standing capacity. This variety is recommended for good humous soils in regions of moderate rainfall. Schwako, a variety of *L. luteus*, is suitable for green manuring; it is less demanding than

sweet lupins and gives high yields of green matter on light soils.

Sugar beet. Multverna has only been granted permission for export, its performance in the German Democratic Republic having not yet been assessed. It is derived from tetraploid families of E, N and Verna lines. Multverna shows resistance to bolting and requires a low temperature for germination, being therefore adapted to early sowing. It resembles Kleinwanzleben Multa morphologically and equals it in yield and sugar content.

216 Neuheiten für die Branche. (**Novelties for the trade**).
Saatgutwirtschaft 1960 : **12** : 186–87.

Maize. Hyperma 288 is a medium-late forage variety outstanding for its resistance to cold in the spring; the grain is yellow and of the flint type. Hymaria 311, also a forage maize, is a few days later than Hyperma 288, the seed being yellow and of the dent type.

Radish. Pinkie is suitable for forcing; it has a round root and short foliage. The root is resistant to cracking and does not become pithy; it has a mild and aromatic taste.

Phaseolus. Rheinperle [Rhine Pearl] has fleshy oval pods green in colour and about 20 cm. long. It is one of the earliest of the stringless climbing varieties with white seed and is very resistant to disease. Rheinperle is high yielding and withstands unfavourable climatic conditions. Goldhilde is a particularly early climbing bean of the wax type; it gives high yields of large stringless pods with white seed and is suitable for forcing.

Pea. Echo is a marrowfat variety giving high yields of good quality seed; it grows to a height of 50 cm.

217 Neuheiten für die Branche. (**Novelties for the trade**).
Saatgutwirtschaft 1960 : **12** : p. 214.

Maize. Hymador 22 is an early-maturing variety suitable for ensilage in unfavourable districts and for grain production elsewhere; it is particularly resistant to cold in spring. The grain is yellow in colour and of the flint type. Hybridor 266 is a medium-early maize which grows well; it is adapted for ensilage and may also be used for grain production in favourable areas. Hybridor 266 is very resistant to cold in spring and yields yellow grain of flint type.

Pea. Vermeer is a sugar pea which grows to a height of 110 cm. and bears well, the pods being free of membrane and tender. The seed colour is green and the harvest begins very early.

218 Lijst van proeven en proefbedrijven van rijkslandbouwconsulenten, instituten en andere instellingen 1960. (**List of trials and experimental farms of national agricultural advisors, institutes and other establishments, 1960**).
Meded. LandbVoorlDienst., Wageningen 1960 : No. 76 : Pp. 124.

This outline of Netherlands field experiments planned for 1960 includes a descriptive list of new varieties of cereals, pea, bean, flax, poppy and potato not included in the 34th official varietal list [cf. XXIX, 4710].

Polyploidiezüchtung bei Futterpflanzen. Vorträge anlässlich eines Symposiums vom 23.–25. Juli 1957 im Institut für Pflanzenzüchtung Gross-Lüsewitz der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin. (**Polyploidy breeding in forage crops. Lectures presented at a symposium held from 23 to 25 July 1957 at the Gross-Lüsewitz Plant Breeding Institute of the German Academy of Agricultural Sciences at Berlin**).
1958 : Pp. 122.

219 *Schick, R. Eröffnung der Tagung. (Opening of the conference). (pp. 1–3).*

This opening talk includes a brief survey of the current main lines of plant breeding research in Eastern Germany.

220 *Julén, G. Fertilität bei tetraploidem Rotklee. (Fertility in tetraploid red clover). (pp. 4–11).*

Compared with corresponding diploids, the best Swedish tetraploid selections are more productive, show greater persistence and more rapid growth and have a higher resistance to stem rot and eelworm. They are however less tolerant of drought and rarely give more than half as much seed. This low seed set is partly the result of reduced pollination, for since the flowers have longer corolla tubes, they are less frequently visited by bees. Embryo abortion also accounts in part for low seed set and is thought to be related to irregularities of chromosomal behaviour, the percentage of euploids being 72% in well-developed seeds and only 28% in such shrivelled seeds as were viable, while the corresponding percentages of subtetraploid aneuploids were 7 and 46; the percentages of supertetraploids were similar in all seed fractions. It is noted that, since a small admixture of diploid seed during multiplication will result in an increased proportion of diploids in the harvested seed, strict control of tetraploid seed production is necessary.

221 *Hertzsch, W. Fertilität bei polyploiden Futterpflanzen. (Fertility in polyploid forage plants). (pp. 12–17).*

At Köln-Vogelsang, in crosses between tetraploids from five varieties of red clover, those involving tetraploids of Lembkes were particularly productive, giving high yields of green matter in both first and second cuts. The tetraploids were low in fertility and no self-fertile forms, such as are found among tetraploids of other self-sterile species, have been obtained. The long corolla tubes discourage nectar-seeking bees, so that little pollination occurs. Tetraploids of crimson clover were no higher in yields of green and dry matter than diploids. Open pollination gave 45·14% seed set in C_4 tetraploids, compared with 74·16% in the diploids, while selfing gave the respective values 0·81% and 25·16%; improvement by selection may be possible. In a continuation of earlier work on *Trifolium hybridum* [cf. XXV, 2104], tetraploid material in its ninth year after colchicine treatment equalled diploids in seed yield, giving 320 kg./ha. Tetraploids of *Medicago lupulina* are also poor in fertility, giving a set of 16·58% compared with 49·59% for diploids. Green matter production is high but winter persistence low. Selection over a number of years has appreciably increased the initially low seed set of tetraploid serradella [cf. XXV, 2109].

In *Lolium multiflorum*, seed set after open pollination was 22·02% (range 0–72·55%) in the tetraploids and 70% in the diploids; after selfing the respective values were 0·89% and 0·20%. *Festuca pratensis* had a low seed set in both diploids and tetraploids, with respectively 20·13% and 43·59% after open pollination and 0·03% and 2·45% after selfing.

222 *Focke, R. Einige züchtungsmethodische Probleme des tetraploiden Klees unter besonderer Berücksichtigung seiner genetisch gesteuerten Fertilitätsverhältnisse. (Some methodological problems in breeding tetraploid clover, with special reference to genetically disturbed fertility relationships). (pp. 18–30).*

In the first part of the paper the following work is described. Heterosis in dry-matter content was observed in the diploid F_1 of intervarietal crosses of red clover but disappeared in the diploid F_2 and was not regained in the tetraploid F_2 derived from colchicine-treated F_1 plants. In white clover, a marked inbreeding depression in plant height and breadth was observed; progenies from crosses in the C_0 were highly productive, but sib crosses within the progenies and selfings in the original C_0 population led to a decrease in yield. There were, however, large variations in the sib-cross progenies, indicating an effect of dominant yield genes as well as of heterozygosity.

The rest of the paper discusses the different segregations expected for polygenes and for *S* alleles in $2n$ and $4n$ populations and their bearing on the choice of breeding method.

223 *Hagberg, A. Der Effekt von Mischung und Kreuzung mit diploiden auf polyploide Populationen und andere Erfahrungen der Polyploidiezüchtung in Svalöf. (The effect of mixing and crossing with diploids upon tetraploid populations, and other experiences of polyploidy breeding at Svalöf). (pp. 31–43).*

After noting the value of tetraploids produced by artificial chromosome doubling in beet, turnip and swede and discussing the possibility of increasing heterosis in autopolyploids by building up a high degree of heterozygosity, the author describes some artificially synthesized material of swede rape and swede. The former has been developed from *Brassica napus* var. *oleifera* ($4n$) x *B. oleracea* ($4n$) and includes lines which are more winter hardy than cultivated varieties; the latter comes from *B. campestris* var. *rapifera* ($4n$) x *B. oleracea* ($4n$). In amphihaploids of *B. napus* a relatively high frequency of bivalents is found [cf. XXV, 3169], suggesting that the species is evolutionarily a young one. Work on the effects of competition and intercrossing in diploid, tetraploid and aneuploid rye is described [cf. XXIX, 3770].

In tetraploid Alsike or red clover, a population with an admixture of 2–4% diploids or fewer maintains its high level of tetraploidy since the diploids are unable to set seed; above this value the diploids increase.

224 *Laczynska-Hulewiczowa [Łączyńska-Hulewiczowa], T. Bericht über die bisherige Züchtung einiger polyploider Futterpflanzen. (Report on breeding work on some polyploid fodder plants up to the present). (pp. 44–55).*

Polish work on red clover [cf. XXVIII, 1772 and XXX, 485] and serradella [cf. XXVIII, 1790] is reported.

225 *Schweiger, W. Einige Züchtungsergebnisse bei tetraploidem Klee.* (*Some breeding results in tetraploid red clover*). (*pp. 56–67*).

Tetraploids of the red clover Lembkes, developed at Gross-Lüsewitz, gave higher yields of green matter than diploids, particularly in wet years or when sown as a main crop rather than as an under crop. Seed yield was rather lower than in the diploids but sufficiently variable to permit selection. In yield of dry matter the tetraploids were also rather inferior but improved in subsequent generations. Preliminary work suggests that it may be possible to increase yields even further by combining the polyploids to give synthetics. Significant differences in yield and seed production were detected among five polyploid strains tested in diallel crosses. Self fertility was greater in $4n$ than in $2n$ strains. Work with Alsike clover has shown tetraploids to be particularly productive on heavy soils.

In the discussion which followed the paper, H. Sachs reported that in tests conducted by the Weihenstephan station the superiority in yield of tetraploids was greater under wet conditions but that their seed yield was better under dry; in mixed stands under dry conditions the tetraploids also suffered more from competition from *Lolium multiflorum.* It is noted that, in official varietal trials, tetraploids were no better than diploids of the same maturity group.

226 *Zimmermann, K. F. Polyploidie bei Knaulgras und Glatthafer* (Dactylis glomerata *und* Arrhenatherum elatius). [*Polyploidy in cocksfoot and oat grass* (D. glomerata *and* A. elatius)]. (*pp. 68–72*).

In both the above grasses, colchicine-induced tetraploids were less vigorous and winter hardy than diploids. This may be because both species already have a high chromosome number. The repeated appearance of diploids in clonalized tetraploid material is attributed to reverse mutation.

227 *Ellerström, S. Die Konkurrenzfähigkeit polyploider Rassen von* Phleum pratense *unter verschiedenen Milieubedingungen.* (*The competitive ability of polyploid races of* Ph. pratense *under different environmental conditions*). (*pp. 73–82*).

Plants with $2n = 28$, 42, 56, 70 and 84 occurred in the progeny of a cross between polyhaploids with $2n = 21$. The plants with $2n = 42$ were highest in yield of green matter, and those with $2n = 28$ and 84 were lowest and also highly sterile. Those with $2n = 56$ and 70 formed only bivalents at meiosis and showed good fertility. In tests in which forms with 42, 56 and 70 chromosomes respectively were sown in pure stands and mixed with each other, the 42-chromosome type was best in density of stand and yield of dry matter in southern Sweden, while in northern districts and areas with a higher precipitation the 56-chromosome stands and to a lesser extent the mixed stands did better. In mixed stands with clover a superiority of the 56-chromosome type and the mixture of races in the north and under humid conditions was also observed. The behaviour of the mixtures of races suggests that the races reinforce rather than compete with each other. On the basis of these results, it is considered that unadapted diploids may be used effectively in breeding autopolyploids adapted to given environments and that testing and selection of polyploids should both be effected under various environmental conditions.

228 *Bellmann, K. Unterschiedliche Leistungen von* 2n *und* 4n Trifolium pratense. (*Differences in yield between* 2n *and* 4n T. pratense). (*pp. 83–90*).

The responses of $2n$ Lembkes and the $4n$ strains 227 and 785 to supplies of water varying from 100 to 30% of the water capacity of the soil were studied in pot experiments at Gross-Lüsewitz. At the 100% level the tetraploids were markedly superior to the diploid in green-matter yield and lower in dry-matter content, but with decreasing water supplies, the tetraploids showed a greater decrease in green-matter yield and increase in dry-matter content, so that at the 30% level they equalled the diploid in the former character and approached it in the latter. At all levels the tetraploids were inferior to the diploid in water consumption per g. green matter and equalled it in yield of dry matter, water consumption per g. dry matter, and water consumption per day.

When grown for seed, $4n$ strains remained green for a longer period than diploid Lembkes, and in field experiments their dry-matter content was lower than that of the diploids throughout the vegetative period and increased less during flowering. The latter difference was greater for leaf than for stem dry matter.

229 *Schwanitz, F. Zum Problem der Schaffung leistungsfähiger polyploider Rassen.* (*On the problem of developing productive polyploid varieties*). (*pp. 91–106*).

Heterosis in the F_1 and transgression in the F_2

of *Bryophyllum crenatum* x *B. daigremontianum* is attributed to the effects of growth substances [cf. XXVIII, 2538]. Tetraploids derived from the parental species and from the F_1 had lower values than the corresponding diploids for dry weight, leaf number and, except in *B. crenatum*, plant height; the internodes were generally fewer but longer and the content of growth substances lower. The relation between the observed differences in growth and the effects of growth substances is discussed. Tetraploids derived from the F_2 were very variable, some being superior in productivity to the diploid F_2 plants; it is suggested that some genes governing yield may reach their optimum effectiveness at the tetraploid level.

230 *Schick, R. Schlusswort.* (*Concluding words*). (*pp. 117–19*).

Reference is made to the desirability not only of carrying out short-term breeding projects, but also of building up stocks of variable material which may prove to be useful sources of desirable characters in the future.

231 Génevois, L.
La répartition des vitamines chez les végétaux. I. L'acide ascorbique. (**The distribution of vitamins in plants. I. Ascorbic acid**).
Ann. Nutr., Paris 1960 : **14** : No. **3** : 1–52.

Details of the ascorbic-acid content of a large number of cultivated plants are included in this review. The author draws attention to the possibilities of breeding certain fruit crops with higher contents of this vitamin.

232 Parent, L.
Techniques de pollinisation dans l'amélioration des plantes. (**Pollination techniques in plant improvement**).
Rev. Oka 1960 : **34** : 55–73.

The techniques used in artificial pollination of cereals and forage crops are outlined.

233 Wit, F.
Chemically induced male sterility, a new tool in plant breeding ?
Euphytica, Wageningen 1960 : **9** : 1–9.

In preliminary experiments with small numbers of plants, spraying of red clover, white clover and beet species with solutions of Na 2,3-dichloroisobutyrate (FW–450) shortly before flowering resulted in a moderate to high degree of male sterility without apparent reduction in growth or flowering. Observations on fruit set in beet and red clover indicated that female fertility was little affected in the former but was reduced in the latter. Turnips and perennial ryegrass treated immediately before or at the beginning of flowering showed little or no response.

234 Zimmermann, K. F.
Qualitätsprobleme in der Futterpflanzenzüchtung. (**Quality problems in forage plant breeding**).
Qual. Plant. Mater. veg. 1960 : **7** : 139–46.

Quality in forage plants involves a high content of nutrients and especially of protein. It is shown that the content of nutrients can be raised by selection in plants such as mangels where the nutrients form reserves. In grasses and clovers the nutrients are not reserves and it is difficult to alter the composition of the cytoplasm. However, by increasing the proportion of leaf produced, the yield of nutrients can be raised.

235 Schwanitz, F.
Das Ertragsproblem in entwicklungsphysiologischer Sicht. (**The yield problem from the point of view of developmental physiology**).
Züchter 1960 : **30** : 45–56.

The effects of various characters on the production of plant material are discussed. It is emphasized that further studies in this field would provide information useful in breeding for improved yield.

236 Jaarverslag 1959. Instituut voor Plantenziektenkundig Onderzoek. (**Annual report, 1959. Institute of Research in Plant Pathology**), **Wageningen** : Pp. 186.

The following work is reported in the section on resistance to pests and diseases.

Wheat. A yellow rust which overwinters well and attacks Flamingo but not Heine's VII is thought to be a new physiological race. The smut race 6, originating from Staring, now hardly attacks this variety. Three bunt races appear to occur in the Netherlands; all tested varieties are equally susceptible to all three, except Riebesel 47/51, a *Triticum* x *Secale* derivative, which is fairly resistant to all three. ***Brassica.*** A clubroot race from Didam, which attacks turnip, is distinguished from the Harreveld race by its virulence on marrow-stem kale and winter swede rape; the leaf-radish variety Siletta is resistant. Turnip varieties from Scandinavia, resistant in their own countries, have proved susceptible in Netherlands tests.

Flax. Besides the Russian variety 1288/12 and the Polish variety LCD207, three Netherlands varieties have proved completely resistant to rust.

Cucumber. Of 16 new hybrids and varieties resistant to *Cladosporium cucumerinum*, seven hybrids are also resistant to *Corynespora melonis*, and two varieties and nine hybrids are resistant to the tendency towards bitterness. Resistance to each of the above fungi depends on a single dominant factor.

Phaseolus. A new mutant of the physiological race α of *Colletotrichum lindemuthianum* which resembles race 8 in virulence has been isolated. Some bean varieties resistant to α segregate for resistance to the mutant.

Pea. Among 25 varieties tested, Wyola, Kelva, Kelvedon Wonder and Juwel were the most resistant to the early browning virus, none being completely resistant.

237 MAKKONEN, R. & POHJAKALLIO, O.
On the parasites attacking the sclerotia of some fungi pathogenic to higher plants and on the resistance of these sclerotia to their parasites.
Acta agric. Scand. 1960 : **10** : 105–34.

In studies in which sclerotia of *Sclerotinia* species, *Botrytis cinerea* and *Claviceps purpurea* were infected with 21 isolates of 14 fungal species, one isolate (46) of *S. sclerotiorum* proved resistant to all the attacking fungi; other isolates of the same species, including a saltant of isolate 46, were susceptible. Resistance in *Sclerotinia* appeared to be related to ability to regenerate the cortex at 20° C., to the catalase activity of the cortex and to intensity of respiration.

238 STEPANOV, E. A.
(Stimulating the growth of plants).
Fiz. Rasten. (Phys. Pl.) 1960 : **7** : 237–39. [Russian].

Varietal differences in response to growth stimulants such as KBr were observed in wheat, maize and tomato. Hybrids or varieties of recent origin with an unstable heritable basis responded to treatment by improved growth and development and by increased yield. Older varieties with a conservative inheritance, e.g. the wheat Lutescens 62 or maize Leaming, showed little or no response.

CEREALS

239 BRADY, J. J.
Cereal variety trials at the department's institutions, 1957.
J. Dep. Agric. Irish Free St. 1960 : **56** : 56–57.

A report is given on trials of spring-wheat, oat and barley varieties in the Irish Republic. Among the wheats tested were 22 hybrids from Atle x Progress, the named wheats studied being Atle, Atson and Svenno.

240 PÉREZ-NAVARRO Y FLÓREZ-ESTRADA, A. & MATALLANA VENTURA, J.
Trabajos realizados por la Sección de Cebadas y Avenas del Centro de Cerealicultura de Madrid durante el año 1958. **(Work carried out in the Barley and Oats Section of the Cereal Centre at Madrid in the year 1958).**
An. Inst. nac. Invest. agron., Madr. 1960 : **9** : 69–177.

Among barleys which did well in numerous local trials in Spain [cf. XXX, 237] were Cerro, Carmen and Berta. Support, Silvermine and Gelbhafer [Yellow oats] were among the most productive oat varieties in several localities.

Tien-jarenplan voor graanonderzoek. Verslag over het zesde jaar 1959. **(Ten-year plan for cereal research. Report for the sixth year, 1959).** 1959 : Pp. 160.

241 *Dantuma, G. & Mesdag, J. Verslag over kruisingsprogramma en klimaatresistentie-onderzoek. (Report on the crossing programme and investigations on climate resistance). (pp. 17–32).*

So far, results of tests for seedling cold resistance have not shown any consistent relation to winter hardiness either in wheat or barley.

Wheat. Among varieties from all over the world tested in the greenhouse for resistance to ten races of yellow rust, 14 spring wheats and eight winter wheats have proved resistant to all or most races. Wheats which in their native countries are good in baking quality are not necessarily so in the Netherlands, but the French winter wheat Magdalena and the spring wheats Lee, Selkirk, Strube 4926, Heine 13161 and some others have given good results. Selection and crossing for quality are in progress.

Oats. Crossing with a view to improving nematode resistance has continued [cf. XXX, 2426].

Barley. Crosses have been made among winter varieties to combine winter hardiness and tolerance of low pH with other desirable characters. Breeding for resistance to mildew, yellow rust and oat nematode and tolerance of drought and low pH is in progress in spring varieties.

242 *Meppelink, E. K. Registratie van het bakwaardeniveau van de inlandse tarweoogst 1959. (Record of the level of the baking quality of the Netherlands wheat crop in 1959). (pp. 39–51).*

Details of regional and varietal differences in grain and flour quality and bread-making properties are given for 11 varieties.

243 *Belderok, B. Verslag van het in 1959 verrichte onderzoek aangaande kiemrust en schot. (Report of investigations on dormancy and sprouting carried out in 1959). (pp. 57–67).*

The percentage germination occurring within three days in Petri dishes was determined over a period ranging from two weeks before to eight weeks after maturity in a number of wheats. The marked varietal differences in speed of germination detected corresponded with field observations on sprouting. Each variety differed in behaviour in different years, and controlled tests showed that not only the available water [cf. XXX, 2429] but also temperature affected germination; high temperatures during the milk-ripe stage shortened the dormancy period and the period of slow germination. Preliminary tests have revealed no relation between the results of germination tests and (*a*) the amount of ascorbic acid and catechol-oxidase activity in the grain or (*b*) the histological characters of the grain.

244 *Dammers, J. Onderzoek naar het vóórkomen van de schadelijke faktor in verschillende roggestammen. (Investigation on the occurrence of the noxious factor in different lines of rye). (pp. 69–71).*

Pigs were similar to rats in their growth response on being fed with two varieties, one of which had proved detrimental to growth in rats. No differences in toxic effect on rats were found among genetically identical samples grown under different conditions.

245 *van Dobben, W. H. Verslag von proefnemingen op het gebied van het fundamentele graanonderzoek. (Report on experiments in the field of fundamental cereal research). (pp. 83–93).*

Varietal differences in the decrease in grain number and 1000-grain weight caused by 1 hr. at 47° C. during flowering have been detected among five wheats.

In photoperiodic studies, a winter barley, a winter rye and several winter wheats were sown in autumn in pots, successive pairs of which were brought into the greenhouse (16° C.) at regular intervals after the completion of vernalization in February. One of each pair received normal day lengths in the greenhouse, the other had supplementary illumination. On the assumption that once flowering has been fully induced, supplementary illumination has no further accelerating effect, the results indicate that in the barley Vinesco floral induction under normal lengths is already complete by early February. Rye and wheat react strongly to supplementary illumination at the earliest dates and decreasingly with successive dates, floral induction under normal day lengths appearing to reach completion during April. The wheats fell into two groups, one with a marked early response to supplementary light (Peko, Carsten's VI and Merlin) and the other with a weak reaction (Bonus, Cappelle Desprez and Staring). Under normal day lengths, the north German variety Carsten's VI and the French variety Cappelle Desprez flower simultaneously, but with continuous light the former is much earlier. It appears that it is only in the first two or three weeks after the spring equinox, when the difference in day length between northern and southern Europe is increasing rapidly, that the intermediate day length of the Netherlands has any effect, causing northern varieties to flower late and southern varieties to flower early.

246 *Broekhuizen, S. Het observatieproefveld voor de veenkoloniën in 1959. (The observation trial field for the peaty districts in 1959). (pp. 95–98).*

Data on a yield trial of seven winter wheats are included.

247 *Becker, G. J. F. Het onderzoek van "kafjesbruin" van de tarwe 1959. (Investigations on glume blotch of wheat in 1959). (pp. 127–37).*

The injection method of inoculating wheat with *Leptosphaeria nodorum* [cf. XXX, 2433] gives the highest degree of infection of the methods tested. Correlations for resistance from year to year are not high, nor are those between seedling and adult-plant resistance. The presence of *Sporobolomyces roseus* in the leaves appears to stimulate the development of *L. nodorum*.

248 *Zadoks, J. C. Het gele-roestonderzoek in 1959. (The yellow-rust investigations in 1959). (pp. 139–50).*

In studies of yellow rust infections in Europe, the varieties Alba and Chinese-W were each susceptible to one race and resistant to all others. Heine's VII was susceptible to three races. Probus was moderately susceptible to all races, one of which was almost specific to Probus and was further characterized by avirulence on Rubis and distinct though slight virulence on Hope x Timstein. The Alba, Chinese and Probus races were highly specific with low aggressivity, the first two being also highly virulent, but the Flamingo race attacked three different varieties and was less virulent.

249 *Dantuma, G. Het veredelingsonderzoek met betrekking tot het havercystenaaltje in 1959. (Breeding work in relation to oat nematode in 1959). (pp. 152–53).*

Among 97 oat varieties, only one, *Avena sterilis* 'GH6', failed to develop any cysts when grown in infected soil, while a further ten varieties had only single cysts and three had a few cysts. Ten out of 23 barleys developed one or a few cysts.

250 KOLEV, D.
(Vegetative hybridization of cereal crops).
Selskostopan. Misăl 1959 : **4** : 455–58. [Bulgarian].

The report on transplantations of wheat and rye embryos by Enčev and Cvetkov [cf. XXX, 1399] is criticized for omitting references to previous research along the same lines, including Kolev's experiments in Bulgaria.

251 SANDISON, A.
Note on recommended lists of cereal varieties.
Emp. J. exp. Agric. 1960 : **28** : No. 111 : 255–60.

The significance of the recommended lists issued by the National Institute of Agricultural Botany in influencing the farmer's choice of oat, wheat and barley varieties in England and Wales is analysed.

252 HJELMQVIST, H.
Några växtfynd från Sveriges järnålder. **(Some plant finds from the Swedish Iron age).**
Bot. Notiser 1960 : **113** : 141–60.

Together with data from earlier finds, the present identifications of carbonized remains and impressions in pottery indicate that hulled barley was the most important cereal in the early Iron Age but later, with the increase in the cultivation of wheat, oats and rye, played a less dominant role. Naked barley was less frequent and *Triticum spelta*, *T. monococcum* and *T. dicoccum* were of little importance. The rye found in Gotland had narrower grains than that from southern Sweden or Germany and may have been of a different variety. There is also evidence that rye was introduced earlier into central than southern Sweden.

253 DERENNE, P.
La transplantation embryonnaire chez les céréales. **(Embryonic transplantation in the cereals).**
Rev. Agric., Brux. 1960 : **13** : 124–25.

DERENNE, P.
La transplantation embryonnaire des céréales: problème génétique ou non? **(Embryonic transplantation in the cereals : a genetical problem or not ?).**
Bull. Inst. agron. Gembloux 1960 : **28** : 33–38.

A technique for embryonic transplantation in cereals is described. The technique has been employed, without success, in attempts to facilitate hybridization between rye and certain varieties of spelt. It is suggested that there must be some genetic barrier regulating hybridization between the two species, and that embryonic transplantation cannot overcome this barrier.

In another experiment, the embryos of a fertile dwarf form of wheat were transplanted on to the endosperm of normal plants, and *vice versa*. However, the plants of the F_1 and F_2 generations were completely unaffected by the process.

254 YAMASHITA, K.
A preliminary report of the Botanical Mission of the University of Kyoto (B.M.U.K.) to the Eastern Mediterranean countries, April-July, 1959.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 43–48.

Information is given on the itinerary of the expedition and on the collections of *Triticum* and related genera [cf. XXX, 319].

255 SCHRIMPF, K.
Die Bedeutung bestimmter entwicklungsphysiologischer Beobachtungen für die Züchtung auf Ertrag. **(The significance of certain developmental physiological observations in connexion with breeding for yield).**
Z. Pflanzenz. 1960 : **43** : 390–403.

The adoption of a nine-point scale for readings of such properties as quality and resistance reactions is recommended, so as to make it possible to manipulate the data in computer machinery. Details of developmental stages, yield components and the various factors that influence them are considered and systems of grading, such as that proposed by Feekes [XVI, 1216], that take them into account are recommended. Breeding should, it is submitted, be directed towards producing cereal varieties in which the main tiller and secondary tillers are as nearly as possible of the same size. Varieties with very upright or very pendent habit are rarely found to give the highest yields.

An analysis of the development of winter wheat at Stuttgart-Hohenheim in two different seasons shows the effect of such factors as temperature and rainfall on the yield of grain.

256 Suneson, C. A.
Genetic diversity—a protection against plant diseases and insects.
Agron. J. 1960 : **52** : 319–21.

With reference to investigations on cereals in California, the value of the buffering effects of genetic diversity as protection against diseases and pests, in particular stem rust and Hessian fly, is discussed.

The article includes mention of breeding in California which has led to the development of the following barleys: (1) Atlas 57, resulting from "4 multiple-line backcrossing programs successively recombined"; (2) a Mariout barley constituted by mixing, without further recombination, 173 phenotypically homogeneous lines from five independent back-crossing programmes; and (3) Calif. 1181, a bulk of 366 colourless-aleurone lines selected from Composite Cross II F_{32}. In developing (2), use was made of male sterility to facilitate crossing and all the nonrecurrent parents contributed variously towards resistance to one or more of the four principal diseases of the crop in California.

257 Müller, F.
Untersuchungen zur Physiologie der Kälteresistenz des Getreides. (Über die Beziehungen zwischen Plasmaviskosität und Kälteresistenz sowie über einige vergleichende Untersuchungen des osmotischen Wertes). [**Investigations on the physiology of the cold resistance of cereals. (On the relations between plasma viscosity and cold resistance as well as some comparative investigations of the osmotic value)**].
Kühn-Archiv 1959 : **73** : 296–97.

Amongst hardened plants varietal differences were found in the viscosity of the cytoplasm; in the wheats the viscosity did not show any clear correlation with cold resistance but in the barleys there was a positive correlation. Vernalization reduced the viscosity of hardened winter wheats and of winter and alternative barleys but had no effect on the viscosity of spring barleys. There was no correlation between the osmotic value and the cold resistance in hardened winter and alternative barleys; spring barleys had a lower osmotic value than the other barleys. The monosaccharide content of expressed sap showed no relation to cold resistance in the barleys. Nonhardened wheats and barleys showed only slight differences between varieties in viscosity and osmotic pressure. After plants raised in a greenhouse had been cooled for a short time, the viscosity increased; the increase was much slower in the varieties with high resistance to cold than in the more susceptible varieties. Cooling in the presence of light caused the osmotic value to increase, the extent of the increase being typical for the variety, and in the dark there was no change. From these and other results it is concluded that cold resistance depends on the genetically determined structure of the cytoplasm which varies in hardening ability. Vernalization alters the cytoplasmic structure. Indirect methods of selecting for cold resistance are thought to be of little importance.

258 Grillot, G.
La mise en valeur des terres vierges. (**Opening up virgin lands**).
Bull. tech. Ing. Serv. agric. 1960 : No. 151 : 377–409.

In this account of agricultural progress in Kazahstan and Uzbekistan, mention is made of the work of the Institute of Scientific Research for Cereals at Šortandy in Kazahstan. Breeding is mainly directed to developing short-cycle cereals (85–95 days) resistant to frost and drought, and brief notes are given on some of the hard and soft wheats developed at the institute. A 42-chromosome rye x wheat hybrid has given high yields but baking quality is poor. An awnless oat, resistant to stem rust and lodging and with grains of good quality, has been bred from *Avena sativa* x *A. fatua*.

259 Neururer, H.
Ergebnisse der Krankheitsresistenzprüfung von Getreidesorten in Österreich. (**The results of testing cereal varieties for disease resistance in Austria**).
Bodenkultur 1959 : **10** : 358–72.

The testing methods are described and tabulated data are provided on the susceptibility of wheat, barley, rye and oat varieties to species of *Tilletia*, *Ustilago*, *Fusarium*, *Erysiphe* and *Puccinia*.

260 BARTOŠ, P. & BAREŠ, I.
Odrůdová odolnost pšenic vůči rzi travní (*Puccinia graminis* Pers.) a rzi pšeničné (*Puccinia triticina* Erikss.) a žit vůči rzi travní a rzi žitné (*Puccinia dispersa* Erikss. et Henn.) za přirozené infekce. **[Varietal resistance of wheat to black rust (*P. graminis* Pers.) and brown rust (*P. triticina* Erikss.) and of rye to black rust and brown rust (*P. dispersa* Erikss. et Henn.) with natural infection].**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1033–48.

Many wheat and rye varieties were tested in the field, some of the trials taking place in districts where attack by rust is severe. Of the winter wheats, Béké 233 and 293 and Klein Lucero showed high resistance and the spring wheats *T. timopheevi*, Jumillo, Golden Ball, Trimenia XXIV, Khapli, Acme, Acroma, Mindum, Erythrospermum 142I24, 953IZR, 974IZR and 982IZR, Lutescens 126IZR, Bagé, Centenario [Centenary], Rio Negro and DP 1/13/1 showed little or no damage. No highly resistant winter rye was found but Krmné 89/57 [Fodder 89/57] and Trsnaté [Bush-like] were only attacked to a small extent; land varieties from the mountains were on an average less attacked than recognized Czech varieties. Rye hybrids did not differ greatly from their parents as regards rust resistance.

WHEAT

261 ANTONIANI, C.
Un dodecennio di prove su varietà di grano nella pianura bolognese. **(A twelve year test on wheat varieties in the plain of Bologna).**
Sementi elette 1960 : **6** : No. 3 : 46–55.

The methods used in making variety trials at the Bologna institute of agronomy are described and the results of recent tests on a number of promising lines are presented. They show considerable variation from year to year in most varieties and very few proved better than the local standards over a period of twelve years; those that did included Campodor, I.Bo.1892, Leonardo and Mara.

262 GADEA, M. & ALONSO MARTÍNEZ, E.
Décimo año de experiencias con nuevas variedades de trigo (1957–1958). **[Tenth year of experiments with new wheat varieties (1957-1958)].**
An. Inst. nac. Invest. agron., Madr. 1960 : **9** : 9–68.

In these trials [cf. XXX, 255], the outstanding variety proved to be Dimas; Navarro 122 also gave consistently high yields. Magdalena performed best in the spring-sown trials. Results of a large series of trials of unnamed hybrids are also presented.

263 Wintertarwe, 1960. **(Winter wheat, 1960).**
Landbouwvoorlichting 1960 : **17** : Bijl. 73; Ber. Rassenkeuze No. 290 : unpaginated.

Yield data are given for seven hardy, six fairly hardy, four moderately hardy and two non-hardy varieties tested since 1950 on various soil types in the Netherlands, and also for nine varieties still in the preliminary testing stage.

264 GARCÍA POZUELO, E.
Ensayos comparativos de rendimientos de trigos de origen híbrido (1957–58). **[Comparative yield trials with wheats of hybrid origin (1957-1958)].**
An. Inst. nac. Invest. agron., Madr. 1960 : **9** : 179–213.

Further tests [cf. XXX, 1382] of hybrid selections are reported. Among those outstanding are Canaleja, Canti and Saria. One of the most recently introduced selections, 395–2, showed marked resistance to a severe attack of rust in Vitoria. Other new selections, 406, 419 and 447, have shown promise and will be included in further trials.

265 MARINIČ, P. E.
(P. P. Luk'janenko, the creator of the fatherland's most valuable varieties of winter wheat).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 7 : 9–11. [Russian].

Luk'janenko was awarded the Lenin Prize of 1959 for the breeding and introduction of high-yielding cultivars with good baking and milling properties. Brief descriptions of some of his wheats, which have been in cultivation for a number of years, are given. In addition to these, mention is made of Kuban' 60, Rannjaja 28 [Early 28] and Kolos 26 [Ear 26], which have reached their final trials.

266 Pruckova, M. G.
(F. G. Kiričenko, a creator of high-yielding wheat varieties).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 7 : 12–14. [Russian].

Descriptions are given of high-yielding wheats with good baking properties bred by Kiričenko at Odessa some years ago. In 1959 he was awarded a Lenin Prize. An early winter wheat, Odessa 21 (Hybrid 481 x Odessa 12), which outyields Odessa 3 by 3·3 c. per ha. and resists lodging, is Kiričenko's most recent cultivar. The hard winter wheat Mičurinka [Mičurin wheat] is another recent variety. It was obtained by crossing a high-yielding spring hard wheat with a hardy soft winter wheat and subsequent back crossing to soft winter wheat. It is almost as hardy and productive as the Ukrainian standard varieties of soft winter wheat, but has grain of superior quality.

267 Kuspira, J. & Unrau, J.
Theoretical ratios and tables to facilitate genetic studies with aneuploids. I. F_1 and F_2 analysis.
Canad. J. Genet. Cyt. 1959 : **1** : 267–312.

The identification of monosomic chromosomes in F_1 wheat lines on the basis of the phenotypic difference between the "critical" monosomic F_1 lines, i.e. those carrying a gene controlling the character studied on the univalent chromosome, and the normal disomic F_1s is discussed and tables are given for the genotypes and phenotypes expected for various degrees of dominance in single-gene characters and for the various degrees of dominance and types of interaction in digenic characters in which the two loci are on homologous or nonhomologous chromosomes; differences between the analysis of cytologically identified monosomic F_1 lines and that of mixed, unidentified F_1 lines are noted. In the analysis of F_2 populations from the 21 different monosomic or mixed F_1 lines, it is found that if the F_2 segregation ratio deviates significantly from the ratio in a normal disomic F_2 then the monosome in the F_2 monosomics carries at least one of the genes conditioning the character under study. The results expected for various types of allelic and genic interaction are tabulated and discussed for the F_2 populations. In the F_1 analysis only certain allele-interaction genotypes can be distinguished clearly in "critical" lines, but in the F_2 all types of dominant and recessive genes can be detected, with the single exception of the hemizygous-ineffective recessive.

268 Wunderlich, G. & Hron, R.
Ein Beitrag zur Vererbung der Halmlänge in Weizenkreuzungen. Genanalytische Deutung nach Köhler (1959).
[A contribution to the inheritance of stem length in wheat crosses. An interpretation of gene analysis according to Köhler (1959)].
Bodenkultur 1959 : **10** : 350–58.

A series of crosses were analysed using Köhler's method for progenies showing continuous variation [cf. XXIX, 3331]. In most cases long stem seemed to be under the control of dominant factors, the number of factors varying between 1 and 3 according to the cross; the results of another cross indicated the existence of two intermediate factors for stem length.

269 Kuspira, J. & Unrau, J.
Determination of gene-chromosome associations and establishment of chromosome markers by aneuploid analysis in common wheat. I. F_2 analyses of glume pubescence, spike density and culm color.
Canad. J. Genet. Cyt. 1960 : **2** : 301–10.

The character pubescent *v.* glabrous glumes was investigated in the F_2s from crosses of monosomics I–XXI of Chinese with Sonora. The F_2s of crosses of monosomics I–XXI of Chinese with Little Club were used for the analysis of the inheritance of dense *v.* lax ears. Purple *v.* white culm was studied in 21 lines of Chinese, each with a different pair of substituted chromosomes from Hope and in crosses between ordinary Chinese and Chinese + 2 chromosomes VII from Hope. Pubescent *v.* glabrous glumes depended upon a single pair of genes, chromosome XIV of Sonora carrying the dominant allele (*Pg*) for pubescent glumes and its homologue in Chinese the recessive allele for glabrous glumes. Ear density was controlled by one pair of major genes and at least one pair of minor genes. Chromosome XX of Little Club carried the dominant allele (*Ds*) for dense ears and its homologue in Chinese the recessive allele for lax ears. The genes for glume pubescence and ear density are considered to be good chromosome markers, since their expression did not appear to be influenced by the environment. Culm colour depended upon one pair of genes, with Hope chromosome VII carrying the dominant allele (*Pc*) for purple culm and Chinese VII the recessive allele for white. Culm colour is not a good chromosome marker since it is variable as the result of the influence of the environment. Problems of establishing linkage groups in common wheat are discussed.

270 Fujii, T.
Double recessive plants between *chlorina* and *striata* of *T. monococcum*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 12.

F_1 plants from *chlorina* x *striata* contained $5_{II} + 1_{IV}$ at meiosis and both parents 7_{II}. Normal, *chlorina*, *striata* and double recessives segregated in the F_2. In the F_3, *striata* or *chlorina-striata* plants were derived only from F_2 individuals with the quadrivalent. F_1 plants from crosses of *striata* with the *basi-viridis* I and II, slender and early mutants [cf. XXX, 2494] also contained $5_{II} + 1_{IV}$. The gene for *striata* is therefore situated on one of the chromosomes involved in the reciprocal translocation.

271 Hermsen, J. G. T.
Quantitative investigations on progressive necrosis in wheat hybrids.
Euphytica, Wageningen 1960 : 9 : 141–72.

Progressive necrosis, which appears to result from the action of two, or possibly three, complementary factors designated *A*, *B* and *C*, was studied in several generations of crosses involving either Koga or Eskişehir and in the F_1s of numerous further crosses. Plant height was chiefly used as a measure of the degree of necrosis. Both *AAbb* and *aaBB* varieties fell into three groups on the basis of the degree of necrosis shown in their F_1s with given complementary varieties. These intergroup differences may be attributed either to triplicate genes, A_1, A_2 and A_3 and B_1, B_2 and B_3, possibly located on homologous chromosomes, or to multiple alleles of the necrosis genes. Minor, intragroup differences may be due to different genetic backgrounds or also to multiple allelism of the necrosis genes. The following observations suggest the occurrence of a dosage effect. Both variability and mean degree of necrosis were greater in the necrotic F_2 plants than in the F_1, possibly as a result of the concentration of dominant necrosis genes in the former. A phenotypic and genotypic similarity was detected between the F_1 plants and the least severely affected F_2 individuals. All the F_3 populations showed segregation, indicating that F_2 plants homozygous and dominant for all necrosis genes had not produced seed. In many F_2, F_3 and F_4 populations, phenotypic necrosis classes, each with a definite necrosis genotype, could be distinguished. Evidence of modifying genes was obtained in some crosses. An environmental effect was apparent in the ability of some necrotic F_1s to produce seed when raised artificially although they died under normal conditions.

272 Lupton, F. G. H.
Assessment of the combining ability of winter wheat varieties in breeding for yield.
Heredity 1960 : **14** : p. 458. (Abst.).

"Analysis of the yield components of a diallel series of crosses involving six varieties of *Triticum aestivum*, grown in yield trials from F_1 to F_4 is described.

"The trials in F_1 and F_2 comprised unselected bulks of each cross, together with the parental varieties. Those in F_3 and F_4 consisted of random selections from each cross, with replicated plots of the parental varieties.

"Predictions made from analysis of the results of the F_1 and F_2 trials are compared with estimates of the mean yield and variance in yielding capacity observed in the trials in F_3 and F_4. The value of the analysis of early generation bulk of diallel crosses as a tool in the assessment of the combining ability of varieties of self-pollinating crop is discussed."

273 Rusmini, B.
The breeding of *Triticum durum* by means of interspecies crosses.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 5.

Results at the Stazione Fitotecnica, S. Angelo Lodigiano, Milan, Italy, are reviewed. By repeatedly back crossing *T. turgidum* var. *pseudocervinum* x *T. durum* to *T. durum*, lines with a considerable increase in kernel number per ear and with reduced height, compared with the recurrent species, have been developed. Difficulty has however been encountered in selecting lines at least equal in quality to Cappelli. Back crossing *T. dicoccoides* x *T. durum* has resulted in types with greater winter hardiness, tillering capacity and grain size than the latter parent. From *T. durum* x *T. orientale* lines notable for the large dimensions of the grains have been secured. *T. durum* x *T. timopheevi* crosses have given cold and rust-resistant types. Back crosses of *T. persicum* x *T. durum* have shown particular promise as regards improvements in floret fertility and grain quality. *T. durum* x *T. vulgare* has yielded valuable material with respect to winter hardiness, "humidity resistance," reduced height and fertility. *T. durum* has also been used extensively in hybridization with *Aegilops* and *Agropyron.*

274 Okamoto, M.
Chromosome pairing in the F_1 of monosomic IX (Chinese Spring) x *T. boeoticum* Boiss.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 7.

Four 27-chromosome F_1 plants were examined. Bivalent frequency ranged from 0 to 7. The data suggested that (1) the modal number of bivalents tended to be more or less the same in samples collected the same day from the same plant or even from different individuals, and (2) the mode varied according to the day on which the sample was taken.

275 Belea, A.
Triticum fajhibridek genetikai elemzése, különös tekintettel a rokonsági viszonyokra és a fajhibridek gyakorlati értékére. (**Genetical analysis of interspecific *Triticum* hybrids, with special reference to their affinities and to the practical value of interspecific hybrids**).
Diss. Budapest 1959 : Pp. 123 : from Hungar. agric. Rev. 1960 : 9 : No. 2 : 10–11. (Abst.).

Seed set in interspecific crosses, germination of the F_0 grains and productivity of the F_1 hybrids were greater in crosses within than in those between series. In crosses between series deviating types appear in the F_1, and with increasingly distant relationships between the parents an increasing number of divergent forms appears in the F_2, some of them appearing to be different species from either of the parents. The following conclusions are drawn from the study. *T. aestivum* appears to be more closely related to *T. durum*, *T. carthlicum*, *T. turgidum* and *T. dicoccum* than to the hexaploids *T. spelta* and *T. macha*. *T. aestivum* did not show equal degrees of affinity to all tetraploid species and it appeared to be only distantly related to the diploid *T. monococcum*. Where chromosome homology occurs between the parents of an amphidiploid F_1, some degree of segregation takes place in later generations.

By repeated back crossing and selection, strong-strawed strains resembling Bánkút in ear type but later in ripening than B1201 have been developed. Strains more resistant than Hungarian varieties to stem rust have been obtained from *T. timopheevi* x *T. aestivum* and *T. carthlicum* x *T. aestivum*.

276 Muramatsu, M.
Homology of chromosomes of *Aegilops caudata* with common wheat.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 32–33.

Monosomic V and telocentric XVII of Chinese Spring were crossed with *Ae. caudata*. One F_1 plant ($2n = 27$) deficient for V and another ($2n = 28$) carrying telocentric XVII were studied meiotically. Chromosome XVII was identified as corresponding to the satellited *Ae. caudata* chromosome introduced into common wheat by Kihara. At least six of the *Ae. caudata* chromosomes had considerable homology with wheat chromosomes, the amount of pairing being comparable to that in the diploid hybrids *T. aegilopoides* x *Ae. caudata* and *Ae. caudata* x *Ae. squarrosa*. The reduced pairing in normal *T. aestivum* x *Ae. caudata* hybrids must therefore be due wholly or largely to the effect of chromosome V, which is known to reduce pairing of homologous chromosomes. It appears that the chromosomes of *Ae. caudata* have virtually as much homology with genomes A, B and D of 6*n* wheat as the *T. aestivum* chromosomes have among themselves.

277 Borojević, S. & Borojević, K.
Information on the crossability of tetraploid rye with *T. vulgare* and *Triticale*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 22.

Crosses of *Triticum vulgare* varieties with tetraploids of the ryes Steel and Petkus were unsuccessful in both directions at the Faculty of Agriculture, Novi Sad, Yugoslavia. One of the *Triticale* x tetraploid rye crosses, *Triticale* A x Petkus, was successful. The F_1 plants were completely sterile. "Meiosis showed good pairing of seven rye chromosomes and the rest were as univalents showing the tendency of almost equal distribution (in numbers) to the poles."

278 Nakajima, G.
Frequency of bivalents in meiosis of intergeneric F_1 hybrids between Dinkel wheat and two species of *Secale*, *ancestrale* and *Kukrijanovi*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 24.

Information is provided on bivalent formation in hybrids of *T. vulgare*, *T. compactum*, *T. sphaerococcum*, *T. spelta* and *T. macha* with *S. ancestrale* and *S. kuprijanovii*.

279 EVANS, L. E. & JENKINS, B. C.
Individual *Secale cereale* chromosome additions to *Triticum aestivum*. I. The addition of individual "Dakold" fall rye chromosomes to "Kharkov" winter wheat and their subsequent identification.
Canad. J. Genet. Cyt. 1960 : **2** : 205–15.

A detailed account is given of the procedure used at the Department of Plant Science, University of Manitoba, to develop rye-addition lines of Kharkov, as already briefly described [cf. XXIX, 1014]. Both monosomic and disomic addition types for rye chromosomes I, IV, V, VI and VII have been produced. In the case of chromosomes II and III, only monosomic addition plants have been obtained. With the exception of peduncle pubescence, for which VI is responsible, the individual additions cause only minor quantitative changes in morphology, which were too slight to serve as criteria for chromosome identification.

280 ZENNYOZI, A.
Results of crossings between *Triticum* and *Agropyron*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 25–26.

Data are listed on the results of crosses involving *T. durum*, *T. turgidum*, *T. dicoccum*, *T. polonicum*, *T. persicum*, *T. pyramidale*, *T. orientale*, *T. dicoccoides*, *T. timopheevi*, *T. vulgare*, *T. macha*, *T. compactum* and *T. spelta* on the one hand and *A. elongatum*, *A. junceum*, *A. intermedium* and *A. obtusiusculum* on the other at the Biological Laboratory, Gumma University, Japan.

281 PRUCKOVA, M. G. & ARTEMOVA, A. S.
(A new early wheat variety for virgin land).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 67–68. [Russian].

Pšenično-pyrejnyj Gibrid 56 [wheat-*Agropyron* hybrid 56] was obtained by crossing the F_8 of [(Lutescens 62 x *Agropyron glaucum*) x Lutescens 328] with the spring wheat-*Agropyron* hybrid Skorospelka [Early] at the Kazah branch of the Main Botanic Garden of the USSR Academy of Sciences. It is a spring variety with a growth period appreciably shorter than those of Smena [Change], Akmolinka [wheat from Akmolinsk] and other varieties grown on virgin land. It is resistant to bunt, smut, lodging and shedding and is suitable for combine harvesting. It has large vitreous grain.

282 ELLIOTT, F. C.
Further information on an X-ray induced translocation of *Agropyron* stem rust resistance to common wheat.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 26–27.

The author has reported the development of a stem-rust resistant translocation stock of common wheat by X irradiation of the F_1 of a cross between a resistant derivative of *A. elongatum* x 6*n* wheat and the susceptible variety Idaed [cf. XXVIII, 277]. The stem-rust resistance of this stock paralleled that shown by the parental *Agropyron-Triticum* derivative; a major part of the resistance of the latter has therefore been transferred to hexaploid wheat.

283 KONZAK, C. F. & HEINER, R. E.
Progress in the transfer of resistance to bunt (*Tilletia Caries*, and *T. foetida*) from *Agropyron* to wheat.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 31.

Transfer of a chromosome responsible for bunt resistance from *A. elongatum* ($2n = 70$) to *Triticum compactum* 'Elgin' ($2n = 42$) by back crossing to Elgin was completed by F. C. Elliott. The authors have selected many bunt-resistant lines from this material. All resistant lines have $2n = 44$, some have 42 normal chromosomes + a pair about half the size of normal chromosomes. The smaller pair may be isochromosomes of the segment responsible for resistance. All lines carrying 42 chromosomes were susceptible; no substitution lines have therefore been produced. Lines with $2n = 42 + 2$ isochromosomes appear to be agronomically superior to $2n = 44$ lines. The possible inferiority of the latter may stem from the fact that the complete *Agropyron* chromosomes carry genes for undesirable characters, which are not present in the corresponding isochromosomes. The isochromosomes may be readily distinguished in both mitotic and meiotic cells. A number of the lines are stable in chromosome behaviour and thus also in bunt resistance. Induction of transfer of a segment carrying the resistance to a normal chromosome of Elgin is being attempted by X irradiation.

284 TABUSHI, J.
Aneuploids found in synthesized wheats, ABD Nos. 4 and 5.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 33.

Several aneuploids were found in the synthesized

6*x* wheats ABD 4 and 5 [cf. XXIX, 2453]. Those with $2n = 41$ usually had associations of $1_{I} + 20_{II}$, $3_{I} + 19_{II}$ or $5_{I} + 18_{II}$ at metaphase I. Five individuals of ABD 4 with $2n = 41$ were back crossed to *Triticum persicum* var. *stramineum* and *T. persicum* var. *fuliginosum*. Observations on associations in the progeny ($2n = 33$–35) indicated that the $2n = 41$ aneuploids had lost one chromosome from genome A or B.

285 Rommel, R. & Jenkins, B. C.
Amphiploids in *Triticinae* produced at the University of Manitoba from March 1958 to December 1959.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 23.

A list is given of amphidiploids between (1) *Triticum durum* and *Secale* spp., (2) *T. aestivum* x *Agropyron elongatum* and (3) *T. aestivum* x *Secale* spp. Information on growth habit is included.

286 Katsuya, K.
Susceptibility of chlorophyll mutants of Einkorn wheat to stem and leaf rusts, *Puccinia graminis* and *P. triticina*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 14.

Normal, *chlorina*, *basi-viridis II*, *virido-albina* and *albina* seedlings of *Triticum monococcum* var. *flavescens* were susceptible to race 17 of stem rust. With regard to race 21B of leaf rust, normal and *chlorina* seedlings were resistant to moderately resistant; *virido-albina* showed moderate resistance to susceptibility in both the green and white parts and *albina* resistance.

287 Scossiroli, R. E.
Radiation experiments on *Triticum durum* and *Triticum vulgare*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 6.

Investigations have been initiated at the Institute of Genetics, University of Pavia, Italy, to study the induction of mutations in polygenic systems. Data are reported on alterations in growth shown by the R_1 raised from seed of T. *durum* 'Cappelli' and *T. vulgare* 'Damiano' and 'Mara' exposed to 10,000 r. of X rays. Variability for polygenic traits in both the treated and untreated series is to be determined in a continuation of the work.

288 Fujii, T.
Crossing experiments between *basi-viridis* II and other mutant strains of *T. monococcum*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 11.

[Cf. XXX, 2494].

289 Matsumura, S.
Genetic effects of β and γ radiations on Einkorn wheat.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 10–11.

Seeds of *Triticum monococcum* var. *flavescens* were exposed to β rays from P^{32} and I^{131} and to γ rays from Co^{60}. Data were recorded on seedling growth, R_1 fertility, chromosome aberrations in R_1 PMCs and R_2 chlorophyll mutations. The frequency of chromosome aberrations was strikingly high with γ treatment. The frequency of chlorophyll mutations increased with increase in dose of both types of radiation, the majority of those induced by β treatment being *albina*, *xantha* and *viridis*, while γ exposure frequently induced the *albo-viridis*, *virido-albina* and *basi-viridis* types. The effects of β radiation from 0·4 mc./gm. P^{32} corresponded roughly to those of 5·0 kr. γ radiation and the effects of β radiation from 0·2 mc./gm. P^{32} and 0·8 mc./gm. I^{131} to those of 2·5 kr. Assuming that the effects of β radiation were confined to the embryo, it was calculated that 0·2 mc./gm. P^{32} was equivalent to 2·4 kr., this estimate being in agreement with the actual data.

290 Matsumura, S.
Genetic effects of thermal neutrons on wheat.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 8–9.

Frequencies of chromosome aberrations and chlorophyll mutations induced in *Triticum monococcum* var. *flavescens* by thermal-neutron treatment of the seeds increased in proportion to the dosage. Observations on R_1 seedlings showed *T. monococcum* to be more sensitive to thermal neutrons than *T. durum* and *T. vulgare*; the two polyploid species did not differ significantly in sensitivity.

291 Bonfiglioli, O.
L'apporto dei frumenti italiani nel miglioramento della granicoltura di paesi europei. (**Contribution of Italian wheats to improvement of wheat cultivation in European countries**).
Sementi elette 1960 : **6** : No. 3 : 30–37.

The more recently bred Italian wheats are adapted to conditions of high fertility and in Greece have proved less successful than the older varieties such as Mentana. In Bulgaria they have done less well than expected owing to the use of seed of inferior quality. In Spain, recent Italian varieties such as Funo, Mara and Florio have given good yields, as well as older varieties such as Rieti and Mentana; in Portugal Autonomia, Impeto, Tevere and S. Pastore among recent varieties and Quaderna, Mentana and Roma among the older ones have done well, a number of more recent varieties being also under trial; in Yugoslavia Italian wheats have given mean yields of about 40 c. per ha. compared with 15–30 c. from the local wheats [cf. XXX, 1408], the best yields being over 96 c. per ha.; several have shown satisfactory resistance to cold. No Italian wheats are grown at present in France but Salto is grown in the Tessin in Switzerland.

292 Frumenti Italiani in Iugoslavia. **(Italian wheats in Yugoslavia).**
Ital. agric. 1960 : **97** : p. viii.

Further data [cf. XXX, 1408] show that some of the Italian wheats have given higher yields in Yugoslavia than in Italy; thus San Pastore has produced yields of up to 51·4 c. per ha. and good yields have also been given by Abbondanza, Fortunato, Funo and San Marino. Trials are now being made with Italian wheats in Bulgaria, Rumania and Poland.

293 Rotini, O. T.
I frumenti italiani vittoriosi in Jugoslavia. **(The Italian wheats victorious in Yugoslavia).**
G. Agric. 1960 : **70** : p. 311.

The mean wheat yield in Yugoslavia has risen from 11 c. per ha. in 1930–39 to 19 in 1959, the improvement being largely brought about by the introduction of new wheat varieties from Italy [cf. XXX, 1408 and XXXI, 292], from which yields of up to 49·53 c. per ha. have been obtained in favourable areas such as the Vojvodina.

294 Kyjak, G. S.
(The cultivation of wheat in the western provinces of the Ukraine).
Visn. Akad. Nauk Ukrajin. RSR (Rec. Ukrain. Acad. Sci.) 1959 : **30** : No. 5 : 46–50. [Ukrainian].

Three recent varieties selected from local material are described. The winter wheat Galc'ka [wheat from Galicia] is winter hardy, moderate in its nutrient requirements and outyields older varieties. The soft spring wheat Dubljanka 4 [wheat from Dubljany 4] has large grain, is resistant to *Puccinia* and lodging and outyields the previous standards in the L'vov and adjacent provinces of the Ukraine. Novopodil'ska [Novyj Podol] is a hard wheat resistant to *Puccinia* and *Ustilago*. It outyields Arnautka Nemerčanskaja, has larger grain and is better in macaroni quality.

295 Trond—en ny høsthvetesort. **(Trond—a new winter wheat variety).**
Samvirke 1960 : **55** : 538–39.

Developed at Weibullsholm, Sweden, Trond has proved better suited to Norwegian than Swedish conditions. In tests in south-eastern Norway, it has outyielded all other varieties and was five days earlier than Odin. Its straw is short but less strong than that of Odin.

296 Aziz, M. A.
Two new general purpose wheats for the irrigated areas of former Punjab, C271 and C273.
Agriculture, Pakistan 1960 : **11** : No. 1 : 49–52.

C271 (C230 x IP165) is a beardless variety with moderately-dense, medium-long ears, white densely felted glumes and plump amber grains. C273 is a bearded type with medium-sized lax ears, white, sparsely felted glumes and hard, plump, amber grains. The yielding ability of both varieties is as high, or higher, than that of C591, C518 and C228. The new varieties are suitable for early or late sowing on soils of average or high fertility under irrigation; they show resistance to yellow and brown rusts and also to lodging.

297 Heyne, E. G.
Registration of improved wheat varieties, XXIII.
Agron. J. 1959 : **51** : 689–92.

Registered by the US Department of Agriculture in cooperation with the American Society of Agronomy, the following varieties are described: Brevor [cf. XX, 1566], Burt [XXVII, 2815 and XXVIII, 1506], Marfed [cf. XVIII, 822], Omar [XXVII, 1571 and 2650], Idaed, Lemhi, Lemhi 53 [cf. XXIV, 2856], Pennoll [cf. XXI, 2567], Russell [cf. XXVI, 3153], Centana [cf. XXVIII, 4049], Rescue [cf. XVI, 1053], Langdon [cf. XXVI, 3206], Ramsey [cf. XXVI, 3206] and Elmar [cf. XX, 1566].
Idaed is a good-quality high-yielding soft white spring wheat selected from Sunset x Boadicea. Lemhi is a soft white spring wheat bred from

Federation x Dicklow; in states where stem rust is prevalent it is being replaced by Lemhi 53.

298 Holland, D. A.
Tascosa winter wheat rates high in Texas.
Crops & Soils 1960 : **12** : No. 9 : 25–26.

This new hard red wheat has been released by the USDA and the Texas Agricultural Experiment Station. In yield trials it has performed successfully, particularly in the high and rolling plains of Texas. The test weight surpasses that of most varieties currently grown in these areas. Tascosa has a shorter straw that any other commercial variety except Triumph and is quite resistant to lodging. Its flour-making properties have proved satisfactory. It is somewhat susceptible to stem rust and is not recommended for north central Texas because of its susceptibility to diseases in that area.

299 Rosen, H. R., Thurman, R. L. & Templeton, G. E.
Ace, a new soft winter wheat.
Arkans. Fm. Res. 1960 : **9** : No. 4 : p. 2.

This variety has been released primarily because of its resistance to Hessian fly and because it can be planted in the early autumn at the same time as oats. It is average in height, matures at midseason, and has strong straw. The yielding ability is similar to that of Taylor and Chancellor in the Southern USA but lodging is much less severe than in Chancellor. The variety is resistant to powdery mildew, soil-borne mosaic virus, most races of leaf rust and some of loose smut and joint worm; it is moderately resistant to speckled leaf spot.

300 Middleton, G. K., Hebert, T. T. & Davis, W. H.
New varieties for North Carolina.
Res. & Fmg. 1959 : **18** : p. 11.

Wakeland is a new high-yielding early-maturing wheat with short straw; it is recommended for the coastal plain area. The lucerne du Puits is recommended for mountain regions.

301 **Wheat breeding and varieties in Australia.**
Sci. Bull. Dep. Agric. NSW 1958 : No. 76 (revised) : Pp. 223.

Sections on the early history of wheat varieties in Australia, recent breeding for stem-rust resistance, breeding for better baking quality and breeding durum wheats are followed by a comprehensive descriptive list of old and new varieties. The list includes information on origins.

302 Remeslo, V.
(The promising winter wheat variety Mironovka 264).
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1959 : No. **7** : 14–15. [Russian].

This new cultivar was obtained by training an unspecified spring wheat for winter habit at Mironovka in the Ukraine. It outyields Ukrainka, Erythrospermum 15 and Belaja Cerkov' 198, partly because of its improved overwintering ability and partly because it develops a greater number of productive ears and larger grain. It is a strong wheat resistant to *Puccinia*, lodging, *Phytophaga* and *Oscinella.*

303 Makarov, N. M.
(Our successes in improving seed production).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. **4** : 8–9. [Russian].

Improved varieties of crop plants recently introduced on a farm in the Kujbyšev province include the new spring-wheat standard Lutescens 801, which shows improved resistance to shedding by comparison with Lutescens 62.

304 Kostecki, J.
Główne założenia hodowlane i ich realizacja w okresie dwunastoletniej pracy nad hodowlą pszenicy ozimej "Małgorzatka Udycka". **(The bases of plant breeding and their application in the course of twelve years of work on breeding the winter wheat Małgorzatka Udycka).**
Postępy Nauk Roln. 1960 : **7** : No. **1** : 65–78.

Observations on 13 winter-wheat varieties from Germany and Sweden showed them to be less winter hardy than the 9 Polish wheats with which they were compared. The yield of some of the foreign varieties was below 4 c. per ha. whereas that of the Polish wheats was 13–28 c. per ha. The best of the foreign wheats, Derenburger Silber [Derenburg Silver] and Peragis, were crossed with some of the Polish wheats, which were also crossed with Carstens V which, though insufficiently hardy in Poland, is possessed of high yielding abilities. The progenies were grown in two different areas differing in soil and climate. Tests of local varieties showed that in the area with the more severe climate only awned wheats do well whereas in the milder area the best wheats include both awned and awnless forms.

The segregating generations were selected primarily for winter hardiness, in which one of the most promising crosses was Eka ♀ x Derenburger Silber ♂. In this and other crosses a negative correlation was found between earliness and standing capacity; forms combining earliness, high yield and strong straw were found only in the F_6; one line, 03 (5^d), proved to be the best in respect of yield and other characters such as disease resistance and grain type and gave 40 c. of grain per ha. in tests in 1954 and 56·8 c. in 1959 and has been released under the name Małgorzatka Udycka. It is distinguished by a relatively wide range of adaptability; this is explained by the range of ecological types included in its pedigree, which is shown.

305 EGOROV, A. I.
(Growing strong-floured wheat and other valuable varieties).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 6–7. [Russian].

Mention is made of a recent strong-floured spring wheat, Saratov 29, which has been introduced on a farm in the Kujbyšev province. It is resistant to *Ustilago*, lodging and shedding and outyields Lutescens 62 and Albidum 43, which it has superseded.

306 KUCKUCK, H.
On the findings of *Triticum Spelta* L. in Iran and on the arising of *Triticum aestivum*-types through crossing of different *Spelta*-types.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 1–2.

Further investigations on *T. spelta* from Iran [cf. XXVIII, 1509 and XXX, 288] have included anatomical studies of the rachis. The anatomy of some Iranian samples was identical with that of *T. spelta* of Swiss origin. Other specimens were distinguished by a less pronounced formation of the parenchyma cavity in the nodes of the rachis below the spikelets, disarticulation thus being more difficult. Cultivated in Germany, Iranian *T. spelta* underwent no spontaneous disarticulation of the upper part of the rachis, differing in this respect from European *T. spelta*. Winter, summer and intermediate types were found among the Iranian collections. Variability in morphology was somewhat limited. The finding of disarticulating but free-threshing types is of particular interest from the phylogenetic point of view. In general, crosses between Iranian and European *T. spelta* do not segregate for characteristics of this species. Free-threshing plants corresponding to the *compactum*, *subcompactum* and square-head types appeared in only a few progenies. These types also occurred, but in greater frequency, in *T. spelta* from Asturias x *T. macha*. The free-threshing segregates are fairly constant and are now undergoing cytogenetical analysis. It may be concluded that the genetical basis of *spelta* characteristics is the same in *T. macha* and *T. spelta* from Europe and Iran. The occurrence of small structural chromosomal differences must however be assumed to provoke disturbances in the meiosis of hybrids between different *T. spelta* types and to lead to chromatin-bridge formation. Chromosomal rearrangements could thus be responsible for the origin of free-threshing forms. Possibly chromosome IX, carrying *Q* for the suppression of *spelta* characters and *B* for awn suppression, is particularly susceptible to rearrangement. Although *T. spelta* from Asturias and *T. macha* are awned, some of their hybrids were awnless; only in the progenies of such hybrids has segregation of *compactum* and other free-threshing types been observed. It is concluded that (1) cultivation of *T. spelta* in Iran does not trace back to introduction from Europe, (2) *T. spelta* from both regions has a common origin and (3) *T. spelta* is the original form of cultivated 6*x* wheats. There are several possibilities for the origin of free-threshing wheat from *T. spelta*, e.g. many naked types with tough rachis have arisen in crosses within *T. spelta*.

307 KANIEWSKI, K.
La trasformabilità del *Triticum durum* in *Tritic. polonicum*. **(Possibility of transforming *T. durum* into *T. polonicum*).**
Ital. agric. 1960 : **97** : 577–86.

Certain wheats previously classed as *T. polonicum* have, when crossed with other species, given rise to different types of progeny from those obtained from the corresponding crosses with true *T. polonicum*. Thus in crosses with *T. vulgare* forms resembling *T. dicoccum* arise, and in crosses with *T. durum* the progeny resembles that from *T. polonicum* x *T. dicoccum*. The author considers that the form in question, which he refers to as *T. polonicoides*, has arisen from *T. dicoccum* by a mutation similar to that responsible for the origin of *T. polonicum* from *T. durum* and anatomical data are presented showing that the pericarp of *T. polonicoides* resembles that of *T. dicoccum*. *T. polonicoides* is thought to be probably identical with *T. pseudopolonicum* described by Popow and has $2n = 28$.

Forms with polonicoid structure but otherwise resembling *T. turgidum* have been obtained in crosses of *T. polonicoides* x *T. turgidum*, and polonicoid forms otherwise resembling *T. dicoccoides* and polonicoid forms resembling *T. vulgare* from the cross *T. polonicum* or *T. polonicoides* x *T. vulgare*.

308 McGinnis, R. C. & Campbell, A. B.
A case of maintainable hypoploidal variability in a *Triticum aestivum* L. cross.
Canad. J. Genet. Cyt. 1960 : **2** : 47–56.

A full account is provided of investigations already briefly reported [cf. XXIX, 1052].

309 Nezu, M.
Relation of ploidy to radiation effect.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 12–13.

The results of exposing dormant seeds of *Triticum aegilopoides*, *T. monococcum*, *T. dicoccum*, *T. durum*, *T. spelta* and *T. vulgare* to γ rays indicated that reciprocal translocations and other meiotic irregularities increased with chromosome number. The number of breaks per cell increased almost linearly with dose within each of the chromosome-number groups. Seed fertility decreased with increasing dose, the $2x$ species being most susceptible and the $4x$ least susceptible in this respect, with the $6x$ species occupying an intermediate position.

310 Tsunewaki, K. & Heyne, E. G.
The transmission of the monosomic condition in wheat, var. Chinese Spring.
J. Hered. 1960 : **51** : 63–68.

The frequency of monosomics in progenies of selfed monosomics and monosomic ♀ x disomic ♂ was studied for each of the 21 chromosomes. Significant differences in transmission rate were found between types of fertilization and between chromosomes. The monosomic condition was found to be most frequently transmitted in progenies of selfed monosomics 3 and 17 (89·2 and 86·7% respectively) and least frequently in monosomics 20 and 10 (52·2 and 56·9% respectively).

Using data from Morrison [cf. XXIV, 223] and Morrison and Unrau [cf. XXIII, 225] as well as the present data, correlations among frequencies of pollen tetrads with micronuclei, frequencies of chromosome-deficient gametes and frequency of monosomics were studied. No significant correlations were found. The importance of selection and competition among the various chromosome-deficient gametes or zygotes during gametogenesis and fertilization as a factor influencing the monosomic transmission rate is discussed, and in this respect monosomics 3 and 17 are considered to be more favoured and 20 and 10 less favoured than the others.

311 Maróti, M.
Nukleinsäuregehalt der Wurzelspitzen von polyploiden Weizen. **(Nucleic acid content of root tips of polyploid wheats).**
Phyton, Vicente López 1960 : **14** : 135–40.

The content of nucleic acid phosphorus per cell in root tips 1 cm. long increases in the ratio 1 : 3 : 9 in the polyploid series *Triticum monococcum* ($2x$), *T. timopheevi* ($4x$) and *T. aestivum* ($6x$). Values were usually higher in the elongating zone (I) than in the meristematic zone (II) and were higher for RNA than for DNA. For DNA the $2x : 4x : 6x$ ratio was 1·4 : 4·3 : 18·8 in zone I and 1 : 10 : 23·6 in zone II.

312 Pugsley, A. T.
Seed dormancy associated with red grain colour.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 31–32.

Observations on near-isogenic lines with white and red grain derived from the amphiploid Iumillo x *Aegilops squarrosa* back crossed several times to the Australian bread wheat Javelin have shown dormancy to be associated with red grain colour.

313 Saric, M. R. & Cupina, T.
La produttività dei diversi culmi di alcune varietà di frumento. **(The productivity of different tillers of plants from some wheat varieties).**
Sementi elette 1960 : **6** : No. 3 : 38–45.

Observations in Yugoslavia showed that most Italian wheat cultivars had a lower number of productive tillers than the local wheats when grown under the same conditions of spacing, the highest being S. Pastore among the Italian wheats and U–1 among the local. The main ear of the plant was superior to the others in number and weight of grains.

314 Kamal, M. A. M., Refaii [Refaʻi], F. Y. & Bishay, R.
Ash content and its correlation to some biochemical constituents in different varieties of Egyptian wheat kernels.
Alexandria J. agric. Res. 1958 : **6** : No. 2 : 3–12.

Analysis of Baladi [Local], Hindi D, Tousson and Giza 139 showed ash content to be significantly influenced by variety. The correlation between ash and crude protein contents was significant at the 1% level (r = 0·049). No correlation was found between (1) ash content and gluten quality, (2) crude-protein content and gluten quality or (3) ash content and diastatic activity.

315 Threlkeld, S. F. H.
Some studies concerning the metabolic basis for the speltoid-compactoid series in *Triticum vulgare*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 2–4.

Extracts of seedlings disomic and tetrasomic for chromosome IX did not differ in indoleacetic acid oxidase activity. The heights of mature disomic and tetrasomic plants measured 111 and 52 cm. respectively.

316 Wisłocka, M.
Wpływ krótkich fotoperiodów na morfologię kłosa pszenic jarych i ozimych (*Triticum vulgare*). [**The influence of short photoperiods on spike morphology in spring and winter wheats (*T. vulgare*)**].
Acta agrobot., Warszawa 1959 : **8** : 49–65.

When a number of wheats were subjected to 12-hour photoperiods for 20–25 consecutive days, an increase in number of branched spikes was observed, varietal differences in the percentage of branched spikes and in the type of branching being found. For any one variety, the greater the percentage of branched spikes, the greater their morphological deviation from normal. Spring wheats showed a more marked response to short photoperiod than winter varieties. Spring and winter varieties both developed an increased number of spikelets, but in the spring wheats the spikes tended to become shorter and more compact while in the winter wheats they became longer.

317 Mauzé, C.
Les problèmes de la qualité des blés. (**The problem of wheat quality**).
Bull. Éc. franç. Meunerie 1960 : No. 178 : 195–98.

Information on the quality of some French varieties is presented. It is stated that at present an excessive number of varieties are in use.

318 Aufhammer, G.
Klebermenge und Klebergüte des Weizens in ihren Beziehungen zu Qualität und Ertrag unter dem Einfluss der Umwelt. (**Gluten content and gluten quality in wheat in relation to quality and yield under the influence of environment**).
Bayer. landw. Jb. 1959 : **36** : 651–78.

A report is given of the tests of baking quality carried out in the years 1935–49 with 374,612 winter and 28,163 spring wheat samples from different parts of southern Germany. The effect of various factors such as rainfall, sunshine and temperature on the content and quality of the gluten is considered. An important factor is disease: one line from a cross Tassilo x Strubes Dickkopf, and most of its derivatives, proved so susceptible to glume browning caused by *Septoria* (*Leptosphaeria*) *nodorum* that they have had to be discarded. The mean gluten content was 2% higher in the spring than the winter wheats, which also showed greater varietal differences. Much greater annual variations were observed in gluten content than in its quality, which is characteristic for each variety. There was a general negative correlation between yield and gluten content, both between years and between varieties; the yield of gluten per hectare was greater in the varieties with high yield and low gluten content than in those of the reverse tendency, the difference being 14·4% in the winter wheats and 16·5% in the spring. Taking the gluten content of the winter wheat Tassilo and the spring wheat Janetzki früh [Janetzki Early] as 100, certain varieties were regularly below; this applies to Jubel, with 88·9, Walthari (from Tassilo x Jubel) with 87·8 and Herold (from Jubel x Carsten V) with 99·2; others with low values were Darwin and Firlbeck Winterweizen [Firlbeck winter wheat], both descendants of Arras. Hauter II and its hybrids had consistently high values while Hauter II and Mauerner begrannter Dickkopf [Mauern Awned Squarehead] were the only winter wheats that exceeded Tassilo; these three varieties had the lowest yields in the period 1944–48. In the spring wheats all were inferior to Janetzki früh in gluten content, the lowest being Heines Koga, Nordgau and Lichti, which gave the highest yields.

As regards gluten quality the best varieties are all derivatives of Tassilo, which is a sister line to Hauter II from the cross Arras x Traublinger Land. Both these varieties are inferior in quality and segregation has evidently occurred in respect of genes for quality possessed by the two parents; in the cross of Tassilo with Carsten V, a variety of low baking quality, forms with all degrees of quality appeared and by intercrossing some of the intermediate segregates lines with very good quality have been obtained, suggesting that gluten quality is determined by polymeric genes, some of which are recessive. There is no close association between gluten quality and low yield.

319 Davis, W. H.

Quantitative inheritance studies on protein, texture and yield in segregating populations of soft red winter wheat.

Diss. Abstr. 1959 : **20** : LC Card Mic 59–4684 : 1545–46. (Abst.).

A study was made of four populations from crosses involving Atlas 66 (high protein and hard texture), Leap (low protein and soft texture), Chancellor (low protein and soft texture) and Malakoff-Nittany-3 (extremely soft texture). Heritability estimates for protein content ranged from 54·41% for the low x low combination for protein to 68·54% for the high x low populations. The possibility of improvement in protein content by selection was indicated in all four populations, Leap x Atlas 66 being expected to have the highest and Leap x Chancellor the lowest content. Heritability values for yield varied from 14·02 to 52·90%. Sufficient genetic variability for selection was detected in three populations, but in the fourth population, Malakoff-Nittany-3 x Atlas 66, only 2·4% gain was expected by selection of the top 5% of the families. Heritability estimates for texture ranged from 29·23 to 60·22%. The greatest amount of improvement in this property was predicted for families from Malakoff-Nittany-3 x Atlas 66. Both genotypic and phenotypic correlations were indicative of a negative relationship between yield and protein in three populations. It might however be possible to combine high yield and high protein in some families. Genotypic correlations between yield and texture varied from + 0·71 to — 1·35. Relationships between protein content and texture also varied from population to population, ranging from a positive association of hard texture and high protein to no relationship in one population and a slight negative relationship in families from Leap x Atlas 66.

320 Heslot, H.

***Triticum ispahanicum*: a new species of cultivated wheat from Iran.**

Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 15.

Miscellaneous information is given concerning the above species, referred to as *T. hispahanicum* previously [cf. XXIX, 2495]. Cytological observations on the F_1 of crosses with *T. durum* and *T. timopheevi* suggest that the species has genome AABB.

321 Jakubciner, M. M.

(The breeding value of Chinese wheats).

Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 74–75. [Russian].

The substance of this article is contained in a fuller report which has been already summarized [cf. XXX, 2525].

322 de Cillis, U.

L'apporto del miglioramento genetico alla produzione frumentaria italiana. **(The contribution of genetic improvement to Italian wheat production).**

Sementi elette 1960 : **6** : No. 3 : 12–21.

The mean yield of wheat in Italy rose from 11·9 c. per ha. in 1924–28 to 17·8 c. in 1953–57. Some of the difficulties of assessing how much of this increase is due to improved varieties are examined. Thus in the Foggia plain it has been found that where the mean yield is 25–30 c. or below, wheats belonging to *Triticum durum* give higher yields than those of *T. aestivum*; in Sardinia under similar conditions the bread wheats yield more but under less favourable conditions where the average yield is 10–15 c. the hard wheats yield more in Sardinia too. The relative merits of different cultivars also differ according to the conditions of farming. It is calculated however that 35% of the yield increase is attributable to varietal improvement, 50% in northern Italy, 40% in central and 15% in southern Italy and the islands.

323 McNeal, F. H.
Yield components in a Lemhi x Thatcher wheat cross.
Agron. J. 1960 : **52** : 348–49.

The soft white spring wheat Lemhi and hard red spring variety Thatcher differed significantly in (1) number of kernels per ear, (2) kernel weight, (3) number of spikelets per ear, (4) number of kernels per spikelet and (5) plant height but not in (6) number of ears per plant. Intensity of red kernel colour among the segregates bore no relation to grain weight. The influence of white kernel colour could not be determined because only one white segregate appeared in the F_2 of 154 plants. This result suggests that at least three genes for kernel colour occur in Thatcher. Heritability values for yield and the various yield components, as expressed by the regression of F_3 on F_2 values, were so low that selection for these characters in the F_2 is considered to be of doubtful value. Ear number per plant had the highest regression coefficient (+ 0·356), as well as the highest correlation (+ 0·973) between the F_2 and F_3. Of the various characters associated with yield, only kernel number per plant was highly correlated within both the F_2 and F_3. Components (1) and (6) were more closely correlated with yield than (2).

324 Pendleton, J. W. & Dungan, G. H.
The effect of seeding rate and rate of nitrogen application on winter wheat varieties with different characteristics.
Agron. J. 1960 : **52** : 310–12.

In trials over a three-year period in Illinois the different yield responses of Knox, Pawnee, Vigo and Saline to rate of sowing and N application were not related to the growth characteristics of the varieties. Variety had a greater effect upon grain yield, heading date, test weight, height, straw yield, straw/grain ratio and kernel weight than rate of sowing or N application.

325 Lomnickij, Ja. E.
(The responses of winter-wheat varieties to dressing with fertilizers in the western districts of the Ukrainian SSR).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 26–29. [Russian].

Information is provided on the effects of PK, NK and NPK treatments upon grain yields, 1000 grain weights and protein contents of five cultivars in the L'vov province, varietal differences in response to the treatments being noted. Data on the effects of the fertilizers upon length and diameter of the straw are also given.

326 Zech, A. C. & Pauli, A. W.
Cold resistance in three varieties of winter wheat as related to nitrogen fractions and total sugar.
Agron. J. 1960 : **52** : 334–37.

Changes in N fractions and total sugar in the leaves, crowns and whole plants were compared with changes in cold resistance in freezing-chamber tests of Minturki, Pawnee and Ponca. When data for the three varieties were pooled, cold resistance had significant associations with water-soluble protein, total N and total sugar. The degree of association with these constituents varied, however, according to variety and plant part.

327 Stroun, M., Pugnat, C. & Sandmeier, M.
La vernalisation, le photopériodostade et la résistance au froid des blés. **(Vernalization, the photoperiodic stage and cold resistance of wheat).**
Phyton, Vicente López 1960 : **14** : 121–26.

Evidence from this Swiss trial indicates that the rate of development of vernalized seed depends on the duration of vernalization as well as on the temperature at which the process is completed and the subsequent day length. In a long-day environment, the development of vernalized wheat seed in the field was considerably more rapid when vernalization was prolonged (45–50 days) than when it was relatively brief (19–30 days). Rapid phasic development, coincident with vegetative growth, renders the plant sensitive to cold; this combination was more marked in Cappelle than in any other of the six winter wheat varieties included in the trial. Incomplete evidence indicated that highest cold resistance was present in Heine VII and Carsten VIII. In another trial the cold resistance of two spring varieties, Carpo and Svenno, proved to be equal to that of the winter variety Probus when they were sown on a date in the autumn which proved favourable for vegetative growth but unfavourable for phasic development [cf. XXIX, 2498 and 3621].

328 Chinoy, J. J.
Physiology of drought resistance in wheat. I. Effect of wilting at different stages of growth on survival values of eight varieties of wheat belonging to seven species.
Phyton, Vicente López 1960 : **14** : 147–57.

Eight varieties with maturity periods ranging from 100 to 170 days all tillered simultaneously and were able to survive seven days' wilting through lack of watering at this stage. With similar wilting treatments at the shooting and flowering stages however, later varieties were more severely affected than early. Since soil moisture during the wilting periods was negatively correlated with the temperature, and the relation temperature/soil moisture was also negatively related to survival value, it is concluded that the varietal differences in drought resistance observed are attributable rather to environmental differences at the time of wilting than to genetic differences in the physiological properties of the various wheats.

329 TETERJATČENKO, K. G. & IL'INSKAJA-CENTILOVIČ, M. A.
(The method of evaluating wheat for resistance to lodging).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 72–73. [Russian].

The anatomical method has been modified by substituting safranin for phloroglucin as a stain and taking the preparations from 1 cm. above the first or second node of the plants instead of the centre of the internodes. The method is thought to be suitable for testing winter wheats at early breeding stages and for subsequent varietal trials.

330 DOROFEEV, V. F.
(The role of supplementary roots in the resistance of wheat to lodging).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 70–72. [Russian].

In studies at Derbent the resistance of wheats to lodging at the root was found to depend on the strength of the root system and the number and especially the size of the supplementary roots. A table shows the results of anatomical studies of the supplementary roots for two varieties each of *Triticum durum*, *T. turgidum*, *T. aestivum* and *T. compactum*, each pair comprising a resistant form and one that lodges at the root.

331 ROMAN, T.
Kryteria oceny odmian pszenicy z punktu widzenia ich przydatności do sprzętu mechanicznego. **(Criteria for evaluating wheat varieties from the point of view of their suitability for mechanical harvesting).**
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 751–90.

West European Squarehead wheats (prol. *hygrophilum*), showed less and later germination in the ear than western steppe or forest steppe types (prol. *hungaricum*), which in turn were less susceptible than central European varieties (prol. *sylvaticum*). Resistance to germination in the ear could be assessed from germination tests during harvest and the next few days. In threshing tests, varieties with well-developed grain tended to be the most susceptible to shedding. Degree of shedding was unrelated to compactness of the ear, but was influenced by climatic conditions. Use of the cL_r method [cf. XXV, 252 and XXVIII, 4129] for determining lodging resistance gave results for different varieties which corresponded closely with results from many years' field observations. Data from biometrical measurements [cf. XXVII, 1618] were correlated with those from the cL_r method, the mean correlation being $r = 0{\cdot}77$.

332 POWERS, H. R. (JUN.) & SANDO, W. J.
Genetic control of the host-parasite relationship in wheat powdery mildew.
Phytopathology 1960 : **50** : 454–57.

Studies of *Erysiphe graminis* f. sp. *tritici* cultures 116–2 and 116–3 revealed two independent genes for pathogenicity that were complementary to genes Ml_t and Ml_u in the host [cf. XXVIII, 321]. The alleles for virulence have been designated V_t and V_u and those for avirulence A_t and A_u. The genotype of culture 116–2 is A_t V_u and that of 116–3 V_t A_u. Of 16 possible combinations between the four genotypes of the host and the four of the pathogen, seven resulted in resistant infection types; these are found when at least one gene for avirulence occurs in the pathogen and a complementary gene pair for resistance occurs in the host.

333 SEARS, E. R., SCHALLER, C. W. & BRIGGS, F. N.
Identification of the chromosome carrying the Martin gene for resistance of wheat to bunt.
Canad. J. Genet. Cyt. 1960 : **2** : 262–67.

Monosomics or nullisomics of *Triticum aestivum* 'Chinese Spring' were crossed with White Federation 38, which contains the Martin gene (*M*) for resistance to bunt (*Tilletia caries*) [cf. XXX, 3815]. All F_1 plants were examined cytologically. Monosomic F_1 plants were allowed to self and the F_2s screened with respect to 16 chromosomes. Segregation for resistance was essentially normal except where monosome

XIII was involved, a large deficiency of susceptible segregates indicating that *M* was situated on this chromosome. Tests of the F_3s of F_2 disomic individuals chosen by cytological observation again demonstrated that XIII carried *M*, and they also eliminated the remaining five chromosomes of the complement of 21 as possible carriers of this gene. Final confirmation of the location of *M* was provided by tests of lines of Chinese Spring in which XIII of White Federation 38 had been substituted for the corresponding chromosome of the former wheat; all the substitution lines were resistant.

334 MURAVJOV, V. P.
(The variability of bunt in wheat depending on its development on different varieties of the host plant).
Visn. Akad. Nauk Ukrajin. RSR (Res. Ukrain. Acad. Sci.) 1959 : **30** : No. 3 : 46–56. [Ukrainian].

Belaja Cerkov' 200 and L'gov 3612 showed the highest degree of resistance to bunt among eight winter wheats which had been infected with a strain from the susceptible variety Ukrainka 246. The first generations of the pathogen from different hosts differed in virulence, those from L'gov 3612, Belaja Cerkov' 200 and Erythrospermum 15 being the most aggressive and infecting all other varieties. However a reduction in the degree of infection was observed by the second generation of the pathogen in all varieties, except the susceptible Lutescens 9 and Ukrainka 246.

335 CORBAZ, R.
Une maladie importante du froment: la rouille jaune. **(An important wheat disease: yellow rust).**
Rev. rom. Agric. 1960 : **16** : 45–48.

Of the autumn wheat varieties in French-speaking Switzerland, Mont-Calme 268 and Cappelle are very resistant to *Puccinia glumarum*, while Probus, the most widely cultivated variety, and Mont-Calme 245 are highly susceptible. Of the spring wheats, Huron and Lichti are resistant, while Svenno is susceptible.

336 DIXON, G. E.
Wheat breeding in Kenya.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 16–18.

New lines of work initiated in the recently expanded programme of breeding for rust resistance are described [cf. XXX, 2469].

337 POCHARD, E., HUET, J. & VERGARA, S.
Étude génétique de la résistance à un biotype de rouille noire (*Puccinia graminis* var. *tritici*, race 21). I. Facteurs de résistance portés par les variétés de blé tendre: G 80–3, Celebration, Mac Murrachy et Nord-Desprez. **[Genetic study of resistance to a biotype of stem rust (*P. graminis* var. *tritici* race 21). I. Factors of resistance in the wheat varieties: G80-3, Celebration, MacMurachy and Nord-Desprez].**
Ann. Inst. nat. Rech. agron., Paris : Sér. B. 1960 : **10** : 61–84.

A series of diallel crosses between the varieties involved in this trial has indicated that complete resistance to stem rust requires the interaction of two or three genes. It was shown that G80–3 and MacMurachy carry R_1 and R_3 respectively: both genes are dominant for resistance and are active at the seedling stage and on adult plants. Their effectiveness, however, depends on the presence of alleles at two other loci. R_2, which is carried by G80–3 and Celebration, reinforces the action of R_1 at the adult stage, while R_1, carried by MacMurachy, reinforces the action of R_3. On the other hand, the susceptible alleles r_1 and r_2, carried by Nord-Desprez and MacMurachy, may either inhibit or decrease the action of R_2 and R_1 respectively.

Celebration was found to carry A_1, an additional factor for resistance which is effective only at the adult stage.

338 GREEN, G. J., KNOTT, D. R., WATSON, I. A. & PUGSLEY, A. T.
Seedling reactions to stem rust of lines of Marquis wheat with substituted genes for rust resistance.
Canad. J. Pl. Sci. 1960 : **40** : 524–38.

Lines of the wheat variety Marquis carrying genes *Sr*6, *Sr*7, *Sr*8, *Sr*9, *Sr*10, and *Sr*6 + *Sr*7 for resistance to *Puccinia graminis* f. sp. *tritici* were produced by the back-cross method. "The reactions of these lines to 99 North American cultures of 29 races of stem rust and to 8 Australian cultures were determined. Genes *Sr*6, *Sr*8, and *Sr*9 conferred a uniform type of resistance to most of the cultures. Genes *Sr*7 and *Sr*10 conferred only moderate resistance to a few cultures. Genes *Sr*6, *Sr*8 and *Sr*9 appeared to confer the same kind of resistance in Marquis after 5 backcrosses as in the source varieties, but *Sr*7 and *Sr*10 seemed less effective. Results of the infection studies indicated that *Sr*7 may be allelic with a gene for resistance in Marquis and that at least two alleles conditioning different rust reactions may occur at the *Sr*9 locus. The reaction of the lines with *Sr*6, *Sr*8, and *Sr*9 were nearly identical with those of the Chinese Spring substitution lines, Red Egyptian XX, Red Egyptian VI, and Red Egyptian XIII respectively, which presumably have these genes. The data indicated that *Sr*6 is the same as Sr_{kb_1}. The resistance of lines with *Sr*7, *Sr*8, and *Sr*9 was affected only slightly by temperature but the resistance of lines with *Sr*10 and especially of those with *Sr*6 diminished at high temperature."

339 Fuchs, E.
Physiologische Rassen bei Gelbrost (*Puccinia glumarum* [Schm.] Erikss. et Henn.) auf Weizen. [**Physiologic races of yellow rust (*P. glumarum* [Schm.] Erikss. et Henn.) on wheat**].
NachrBl. dtsch. PflSchDienst., Stuttgart 1960 : **12** : 49–63.

Extensive observations at the Biologische Bundesanstalt, Braunschweig, Germany, have shown that the original differential hosts are inadequate and a number of supplementary hosts have been added. The characteristics of the races that have now been detected are described, it being pointed out that their identification is still largely a matter of approximation owing to the variability of both host and pathogen. Data are given on the occurrence of the races in different parts of Germany and a number of other countries in Europe and in the Near East in the years 1953–58. In northern Europe races 7x and 7/8, 2x and 55, 54 and 27/53 are the commonest; in Switzerland and southern Europe races 7x and 7/8 seem to be absent but race 27/53 is also common.

340 Overlaet, J.
Het optreden in Belgie tijdens het jaar 1958 van fysiologische rassen van bruine roest op tarwe *Puccinia recondita* Rob. = *P. rubigo-vera* (D.C.) Wint var. *tritici* (Erikss.) Carl. = *P. triticina* Erikss. **(The occurrence of physiological races of brown rust [*P. recondita* Rob. = *P. rubigo-vera* (DC.) Wint var. *tritici* (Erikss.) Carl. = *P. triticina* Erikss.] on wheat in Belgium in the year 1958).**
Agricultura, Louvain 1960 : **8** : 491–508.

Tests of uredial samples from 19 localities on eight differential wheats showed that races 11, 14 and 107 were the most prevalent and also the most aggressive, followed by race 68. Details of the adult and seedling resistance of the varieties from which the samples were taken are included. A number of additional differential spring wheats which proved useful in checking doubtful identifications are noted.

341 Allan, R. E., Vogel, O. A. & Johnston, C. O.
Leaf rust resistance of semidwarf winter wheat selections, its inheritance and association with plant height.
Agron. J. 1960 : **25** : p. 408.

The following semidwarf selections possess a useful degree of resistance to leaf rust: sel. 83 from (Norin 10 [Ministry of Agriculture and Forestry 10] - Brevor x Orfed - Hyb. 50–3) x (27–15 x Rio–Rex 53); sel. 88 (Norin 10 - Brevor) x (27–15 x Rio-Rex 53); and sel. 7524 and 7525, both from Norin 10 x Brevor. The amount of resistance varied according to the selection, the number of races under control ranging from 2 to 7 of the 9 tested. Field resistance to leaf rust in 7524 x Burt apparently depended upon a single partially dominant gene and in 7525 x Burt upon a single recessive gene. It is however possible that the same factor controls leaf-rust resistance in both crosses and that epistasis modifies the expression of resistance of heterozygotes from 7525 x Burt, causing such plants to be classified as susceptible. Leaf-rust reaction was not associated with any particular class for plant height in F_2 7524 x Burt, but in F_2 7525 x Burt the four classes representing the greatest heights contained 21% of the resistant plants and 55% of the susceptible plants.

342 Hart, J.
New wheats for 1960 sowings.
Qd. agric. J. 1960 : **86** : 79–81.

Hopps provides an alternative to Lawrence as a dual-purpose variety, while another recently released wheat, Kenora, is intended as a substitute for Gabo, since it is resistant to a new race of stem rust which has recently damaged hitherto resistant varieties such as Gabo and Charter in Queensland. Hopps is also stem-rust resistant.

343 Ignat'ev, B. K. & Sažina, M. A.
(The reserves of increased yields of winter wheat in the Kuban').
Zemledelie (Agriculture) 1959 : No. 7 : 54–58. [Russian].

The principal method recommended for increasing grain production is the introduction of the recent high yielding variety Bezostaja 1 [Awnless 1] from Krasnodar. It has strong flour, is resistant to *Puccinia* and lodging and outyields Novoukrainka 84, Skorospelka 3b [Early 3b] and Bezostaja 4 in most districts of the Krasnodar territory.

344 HIRATSUKA, N.
Susceptibility of various strains or varieties of *Aegilops squarrosa* to yellow rust (*Puccinia striiformis*), brown rust (*P. recondita* f. sp. *tritici*) and black rust (*P. graminis* f. sp. *tritici*).
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 34–41.

Data are recorded on the seedling reactions to the above three rusts shown by 136 collections from the Karakoram and Hindu Kush regions [cf. XXIX, 2534].

BUCKWHEAT

345 PAUŠEVA, Z. P.
(Biological heterogeneity of pollen grains in buckwheat).
Izv. timirjazev. sel'skohozjajstv. Akad. (News Timirjazev agric. Acad.) 1960 : No. 2 : 207–12. [Russian].

The size of pollen grains and fertilizing ability of the pollen of the variety Bogatyr' [Hero] depended on position of the flowers on the plant. The largest pollen with the highest degree of fertility came from inflorescences at the base of the main stem, especially from the central anthers of flowers which opened first.

OATS

346 KELEMEN, I.
Őszi zabbal végzett országos fajtakísérletek eredményei, 1956/1959. **(Results of national varietal trials of oats, 1956/1959).**
Magyar Mezőgazdaság, Budapest 1960 : **15** : No. 2 : p. 13 : from Hungar. agric. Rev. 1960 : **9** : No. 2 : p. 11. (Abst.).

Among six varieties tested in Hungary in 1956–59, H–9 was highest in yield followed by Karcag. Winter hardiness was not satisfactory in any variety.

347 JONES, K. R. & FREY, K. J.
Heritability percentages and degrees of dominance for quantitative characters in oats.
Iowa St. Coll. J. Sci. 1960 : **35** : 49–58.

Data from F_2 and F_5 generations derived from crosses involving *Avena sativa* and *A. byzantina* were used to clarify the relative contributions of the additive and nonadditive components of genetic variance, Clintland and Mo. 0–205 being used to estimate the environmental variance.

The average degree of dominance for heading date was 0·47; for plant height, 0·91; for kernel weight, 1·43; and for yield, 2·45. The average heritability percentages were highest for heading date and plant height and lowest for yield. The correlations between F_5-broad and infinite-generation heritability percentages ranged from 0·95 to 1·00 for the four characters.

Estimates of genetic advance from selection indicated that sizeable gains could be expected from selection in the F_2 generation for any of the four characters. However, selection efficiency was increased considerably by delaying selection until the F_3.

348 YOUNG, W. S.
An inheritance study on certain quantitatively inherited characters.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–6212 : 1988–89. (Abst.).

The following characters were studied in the F_1–F_7 of a cross between the *Avena sativa* varieties Tabor and Craig: (1) total height, (2) length of panicle, (3) length of panicle + top internode, (4) length of top internode and (5) number of internodes. With respect to all five characters, the F_1 had a value intermediate between the midpoint between the parental means and mean of the tall parent. Data on the F_2s from the reciprocal crosses were indicative of the possibility of homozygosity of the two original parent plants and of isodirectional concentration of the genes for tallness and shortness in these parents. Height in the F_2 provided a good indication of the relative height range for the mean of the F_3. Estimates of environmental variance for segregating generations were made on the basis of the assumption of a definable relation between the mean and actual mean square in both non-segregating and segregating generations. Evidence favouring the acceptability of such an estimate was secured for (1), (3) and (4). An estimate of heritable variance among plants was made for each segregating generation. Values derived from data on (1) followed expectations when genetic and environmental variances were assumed to be additive. Variances for (3) and (4) deviated slightly from expectation. Components of variance were calculated according to the assumptions of additive relations between the components of variance due to dominance and additive gene effects and of absence of interactions other than dominance. The variance component attributable to dominance was greater than that due to additive effects for each character except (3). From the analysis of means the component due to additive effects was found to be greater than that due to dominance in the case of (1), (3) and (4). Dominance of genes involved in inheritance of (2) was either slight or balanced in such a way as to escape detection. Analysis of means on the assumption of nonallelic interactions provided a better fit than analysis on the assumption of absence of nonallelic interactions. It was concluded that each character was conditioned by several genes; the relations between the genes were not however clarified. Estimates of gene numbers were made by means of formulae involving parental, F_1 and F_2 means and variances, as well as by information provided by the components of variance analysis and partitioning method. The inconsistency of estimates made by the different methods was interpreted as evidence of unequal effects of the genes concerned.

349 LEININGER, L. N.
Variability in successive backcross generations of oats.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–580 : 3461–62. (Abst.).

Means and variance for yield, heading date, height and weight/volume were obtained in four successive back-cross generations using Cherokee as the recurrent and PI185786 as the nonrecurrent parent. The means for heading date, plant height and weight/volume regressed towards the recurrent parent, but plant height and weight/volume returned at a slower and heading date at a faster rate then expected. Mean yield showed considerable heterosis with no indication of regression to the recurrent parent. Variances generally diminished with successive back crosses, but while plant height and weight/volume diminished very little until the fourth back cross, heading-date and yield variances were higher in the third than in the second and fourth back crosses. Selection for heading date of recurrent parent would probably cause all quantitative characters except weight/volume to approach the recurrent-parent phenotype more rapidly than would random crossing. It is thought that 5 or 6 back crosses should be sufficient for heading date to regress to that of the recurrent parent. The means and variances indicate that epistatic gene action may be involved in heading date and yield, while weight/volume and plant height probably result from dominance and additive gene effects. The rust-resistance gene donated by the nonrecurrent parent did not appear to be linked with the characters studied.

350 RAJHATHY, T. & MORRISON, J. W.
Genome homology in the genus *Avena*.
Canad. J. Genet. Cyt. 1960 : **2** : 278–85.

On the basis of chromosome morphology alone, the authors have respectively assigned the genome formulae AA, AABB and AACCDD to 2*x*, 4*x* and 6*x* species of *Avena*, with the exception of *A. longiglumis* (A′A′) [cf. XXIX, 3760]. Observations on chromosome pairing in the genome combinations AAACD, AABCD, and AAAABB have provided evidence in favour of the correctness of these formulae and indicated that there is no intergenomic homology between A, B, C and D. The genotypes (1) AAACD, (2) AABCD and (3) AAAABB were respectively derived from (*a*) *A. strigosa* (autotetraploid) x *A. sativa*, (*b*) *A. abyssinica* x *A. sativa* 'Garry' and SF–6 (selected tetraploid from *A. abyssinica* x *A. strigosa*) x *A. sativa* 'Clintland' and (*c*) the amphiploid of *A. abyssinica* x *A. strigosa*. PMCs in AAAB hybrids from SF–6 and 68–13 (another tetraploid derivative of *A. abyssinica* x *A. strigosa*) crossed with autotetraploid *A. strigosa* had associations involving 5–10 chromosomes. Reasons are given for not regarding this high degree of association as indicative of homology. Another interesting finding was the unusually high frequency of open bivalents in *A. abyssinica* and its AABB derivatives (SF–6, 68–13 and hybrids of *A. abyssinica* x SF–16). Since 2*x* and 6*x* species usually form 6–7 and 19–21 closed bivalents respectively, it may be concluded that the formation of open bivalents is a distinctive feature of the chromosomes of genome B. Only open bivalents were formed in AAAB hybrids.

351 **Curt, new short red oat variety for west coast area.**
Crops & Soils 1960 : **12** : No. 9 : p. 26.

Developed by the USDA and California Agricultural Experiment Station, Curt is well adapted for both pasture and hay production. It is fully one-third shorter than the standard varieties but produces equally high hay yields because of its resistance to lodging. In 1955–1960 tests throughout California, its grain yield exceeded that of Kanota by 28%. Other valuable properties include tolerance to yellow dwarf, resistance to several races of stem rust and good germination soon after harvest. It is however slightly later and less cold hardy than Kanota.

352 GUL, A. & KOLP, B. J.
Accumulation of nitrates in several oat varieties at various stages of growth.
Agron. J. 1960 : **52** : 504–06.

Wyoming studies involving 12 oat varieties have shown that different varieties accumulate different amounts of KNO_3. This was true irrespective of the stage of growth at which estimations were made. It is suggested that it may be possible to select and breed new varieties of oats for making hay which will have less nitrate and be less toxic to animals.

353 STUKE, H.
Untersuchungen über den Rohfettgehalt des Hafers. (**Investigations on the crude fat content of oats**).
Kühn-Archiv 1959 : **73** : 297–99.

[Cf. XXX, 2568].

354 GRAFIUS, J. E. & KIESLING, R. L.
The prediction of the relative yields of different oat varieties based on known environmental variables.
Agron. J. 1960 : **52** : 396–99.

An analysis which has already been reported briefly is given in full [cf. XXX, 1227].

355 KUMAGAI, T.
Varietal difference in water requirement and water economy in oats.
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 42–48.

Greenhouse experiments on the water absorption of nine varieties introduced into Hokkaido are reported. Marvellous absorbed least water while the ratio water absorbed/dry weight produced was least in Niagara. Varieties with an erect habit tend to absorb less water than prostrate forms.

356 KIRILLOV, JU. I.
(The methods of evaluating the resistance of oat varieties to lodging).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 4 : 44–50. [Russian].

Comparative studies were made of laboratory testing techniques in Estonia, using varieties differing in resistance to lodging from a collection of the Institute of Plant Industry. The most reliable method was the test for resistance of the stems to breaking and it is recommended, together with the vibration test for straw stiffness of Kragel'skij, for early stages of selection. For later stages, beginning with small-scale varietal trials, methods based on straw weight are thought to be useful. Morphological analyses of the length and diameter of internodes and plant height were insufficient for assessing varietal resistance to lodging unless they were supplemented by anatomical studies of the straw. When assessing roughly the resistance of breeding material in the field, three different criteria of lodging should be noted, the resistance of whole stems, resistance at the root and the breakage at internodes.

357 WAHL, I.
Physiologic races of oat crown rust identified in Israel in 1956-59.
Bull. Res. Counc. Israel : Sect. D : 1959 : **8D** : 25–30.

Nine races of *Puccinia coronata* var. *avenae* not previously described are reported. Eight of these can be divided into two groups, one of which (comprising races 311 and 314) is virulent on both Landhafer and Santa Fe while the other (races 312, 313, 315, 316, 317 and 319) is virulent on Santa Fe but harmless on Landhafer. Both varieties are resistant to race 318.

358 WAHL, I.
Reaction of oats endowed with the "Canadian" factors for resistance to physiologic race 6 of oat stem rust in Israel.
Canad. J. Pl. Sci. 1960 : **40** : 447–51.

Resistance to race 6 of *Puccinia graminis* f. sp. *avenae* was studied in 13 oat varieties carrying the "Canadian" genes [cf. XXVII, 1671]. Under field conditions in various parts of Israel, ten of the varieties showed extreme resistance to the pathogen until the beginning of June, when the oats were fully ripe. At this stage any fungal damage that does occur is unlikely to decrease the crop yield appreciably.

Greenhouse studies indicated that seedlings inoculated with race 6 became susceptible to the parasite when exposed to 29° C. for all or an appreciable part of the incubation period. When the seedlings were kept at 29° C. before inoculation took place, their resistance was not affected.

359 **Rust and smut resistant oats in three to five years.**
World Fmg; Kansas City 1960 : **2** : No. 9 : 38–39.

In the F_3 of a cross between a crown-rust resistant, diploid wild oat, Saia, and a tetraploid oat, one plant was found to be rust resistant and fully fertile; a line bred from this parent was named Aberdeen 101. This line has now been crossed with a number of high-yielding, disease-resistant, commercial varieties and from these crosses a new strain is being developed which is reported to be resistant to crown rust, stem rust and smut.

RYE

360 Winterrogge, 1960. **(Winter rye, 1960).** Landbouwvoorlichting 1960 : **17** : Bijl. 71; Ber. Rassenkeuze No. 288 : unpaginated.

In trials conducted since 1951 in the Netherlands, Petkus gave consistently good yields on all soil types but was often exceeded by Dominant and Zelder.

361 Nürnberg-Krüger, U.
Cytogenetische Untersuchungen an *Secale silvestre* Host. I. Der Bastard mit *Secale cereale* L. **(Cytogenetic investigations on *S. silvestre* Host. I. The hybrid with *S. cereale* L.).**
Züchter 1960 : **30** : 147–50.

The cross *S. cereale* x *S. sylvestre* was effected after the flowering period of *S. sylvestre* had been delayed by short-day treatment. Two F_1 hybrids were analysed cytologically; four bivalents and rings or chains of up to six chromosomes were observed and more rarely five bivalents and one chain of four chromosomes. These diacinesis configurations correspond to those found in *S. cereale* x *S. montanum* and it is thought that *S. cereale* and *S. sylvestre* differ by the same two reciprocal translocations as *S. cereale* and *S. montanum.* Stutz's suggestion that *S. cereale* arose by hybridization between *S. sylvestre* and *S. montanum* is thought to be improbable. The F_1 hybrid is morphologically an intermediate type showing heterosis in number of stems per plant, straw length and number of central flowers per ear; male and female fertility are reduced.

362 Krasnjuk, A. A. & Davydov, V. A.
(Winter rye in the South East).
Zemledelie (Agriculture) 1959 : No. 7 : 65–68. [Russian].

Varieties which are winter hardy and drought resistant in the region south and east of Saratov are listed. Volžanka [rye from the Volga] was the most productive of these till the recent accession of Saratovskaja Krupnozernaja [Saratov Large-grained] which outyields it by 2·2 c. per ha. The new variety has long, productive ears with large grains and is vigorous and productive of tillers.

363 Barnes, B. S.
Station releases new rye strain named Explorer.
Miss. Fm. Res. 1960 : **23** : No. **4** : **1**, 8.

Developed at the Mississippi Agricultural Experiment Station, Explorer is a synthetic with light-coloured seeds, developed by combining five inbreds. Its main advantages are high yields of grain and forage and leaf-rust resistance. In the last-mentioned respect, the variety is an improvement over other commercial ryes in the southern USA.

364 Bhattacharyya, N. K. & Jenkins, B. C.
Karyotype analysis and chromosome designations for *Secale cereale* L. "Dakold".
Canad. J. Genet. Cyt. 1960 : **2** : 268–77.

The following types of chromosomes were distinguished in the somatic complement of Dakold 23: type A (chromosomes I, II and III) with median or nearly median primary constrictions but no secondary constriction; type B (IV), having a submedian secondary constriction in the long arm and a short satellite at the end of the short arm; type C (V) with a submedian secondary constriction in the long arm; and types D (VI) and E (VII), respectively characterized by a short satellite and a very pronounced satellite at the end of the short arm. The primary constriction of IV–VII is submedian. Except for III, type-A chromosomes are comparatively long; IV and V are also long; VI and VII are short. Even in the same plate, considerable differences were noted between homologous chromosomes in length. It is stressed that, for correct identification, total length of the chromosome, the separate lengths of the long and short arms, arm index and the detailed morphology of the secondary constrictions all require to be considered. The authors compare their observations with those of previous workers and, with reference to the literature, discuss the nature of the secondary constrictions. Attention is also drawn to a faintly stained region seen in the gap between the satellite and the short arm of VII; whether this represents a Feulgen-positive satellite thread or supernumerary constriction has yet to be checked.

365 ELLERSTRÖM, S.
Effect of aneuploids on the yield of tetraploid rye.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 21–22.

Making use of the correlation existing between seed size and frequency of aneuploids, especially hypotetraploid seeds, it was possible, by sieving, to make up three seed lots of Steel with 30, 19 and 5% aneuploid seeds. The seed lot with 30% gave a significantly lower yield than the one with only 5%. Differences in seed size between the three lots did not influence yield. [Cf. XXIX, 3770].

366 HAGBERG, A. & ELLERSTRÖM, S.
Competition between diploid, tetraploid and aneuploid rye in "tetrarye" populations in practical farming.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 19–20.

The problems discussed have been fully examined elsewhere [cf. XXIX, 3770].

367 BÜHRING, J.
Beobachtungen und Untersuchungen am Winterroggen über Schossverzögerung und Erhaltung von Klonen durch photoperiodische Behandlung. **(Observations and investigations on winter rye on delaying earing and maintaining clones by photoperiodic treatment).**
Z. Pflanzenz. 1960 : **43** : 266–96.

Clones of winter rye were planted in hot-bed frames and during the growth period the frames were covered at 4.30–5 p.m. and uncovered at 7–7.30 a.m.; the covers permitted a little light to enter. This treatment delayed the development of the ears. The diploid clones were of two types with some intermediate forms; one type showed almost no ear development and the other produced ears from shortened leaf sheaths from the beginning of July onwards; some tetraploid clones began earing in August. During the period of treatment the clones continued to produce tillers and they differed in rate of tillering. The production of tillers was stimulated by cutting back the plants and this also helped to retard the development of the ears. Tillering capacity of treated clones was correlated with earing capacity of sister clones in the field.

These experiments show that it is possible to maintain clones of genotypes which are more or less self sterile and difficult to preserve in other ways.

368 MÁNDY, GY. & PÁL, GY.
Adatok hazai nemesített rozsfajták csírázásélettanához. **(Data on the physiology of germination of rye varieties bred in Hungary).**
Növénytermelés 1960 : **9** : 47–58.

In a 24-hour period, grains of the varieties F and Lovászpatona, both of Hungarian origin, attained their maximum water uptake at 30° C., while those of the Petkus derivatives Kecskemét, Kisvárda and Óvár reached it at 40° C. The first two varieties also showed a greater gain in fresh weight during germination. Optimum germination temperature was 10° C. for F, Kisvárda and Lovászpatona and 20° C. for the other two. Maximum germination temperature for all varieties was between 35° and 40° C. Kisvárda was the least sensitive to low temperatures.

369 MOREY, D. D. & MOREY, J.
Polyembryony in American rye varieties.
Agron. J. 1959 : **51** : 669–72.

Examination of 22 varieties for polyembryony showed varietal differences in frequency to be considerable. Twins accounted for 97·5% of the total polyembryony, triplets making up the remainder.

The year of seed production, region where grown, growth habit, winter hardiness, age of seed and viability appeared to have no influence on frequency of polyembryony. A genetic basis is suggested.

Cytological examination of a number of twin rye plants disclosed only diploid types.

370 REHSE, E.
Über die Beziehungen zwischen Strohlänge und Ertrag in Kreuzungspopulationen zweier Roggensorten. **(On the relationships between length of straw and yield in populations from crossing two rye varieties).**
Z. Pflanzenz. 1960 : **43** : 157–204.

Few exceptions have been found to the general rule that short-strawed ryes are lower in yielding capacity and investigations were undertaken to determine whether the correlation was physiological or the result of genetic linkage. Studies on various progenies of the rye 'Carstens Kurzstroh' [Carsten's Short Straw] that had been grown in close proximity to Petkuser Normalstroh [Petkus Normal Straw] showed high correlations between plant height and grain yield. Values based on the longest tiller were found to correspond closely to those for the entire plant. The degree to which the values could be modified by environmental effects was investigated on two populations that were divided into two separate portions, which were grown in different places; also by a 10 x 10 Latin square sown with 100 plants of Carstens Kurzstroh; the results show that variance due to environment was greater than the residual variance only for number of tillers per plant and ear density, whereas for height of plant, length of ear, number of spikelets, number, yield and weight of grain and number of grains per spikelet (fertility) the differences seemed to be primarily genetic. In the group of progenies with medium-long straw, though there was a general positive regression between length and grain yield of the longest tiller, several exceptional individuals were found in which the correlation was broken; this occurred in 57 of the 93 families examined, the number of exceptional individuals found being 3 in 3 of the families, 2 in 20 families and 1 in 34. In most individuals the linear regression between height and grain yield of the longest tiller was present but the yield was greater and the height less than expected. The correlation between tiller number and height and yield of the longest tiller, usually found in other families, was also absent in these plants. The correlations were studied also in the progenies of the deviating plants; in three cases the correlation between height and yield of the longest tiller was absent also in the progeny. These three progenies were examined for other correlations; one had a correlation of straw length with ear length and number of spikelets and the two others had a correlation only between straw length and 1000-corn weight, whereas other progenies grown in the immediate vicinity showed most of the expected correlations. In some progenies there was a correlation in some tillers but not in others. Recalculation on the basis of the whole plant rather than the longest tiller did not however alter the results significantly. The occurrence of the three progenies without the correlation is regarded as an indication that the association between height and yield is due to genetic linkage, though the evidence is insufficient to establish this definitely. There was considerable variation in the degree of correlation in the different progenies; only in two progenies was there a correlation between fertility and height and it is thought there should be no difficulty in breeding a short rye with high fertility and high 1000-corn weight. Data are cited from the literature to show that increases in yield are not invariably associated with taller plants. Hence a method for breeding high-yielding short-strawed ryes is suggested, consisting in growing emasculated plants of a short-strawed form surrounded by a high-yielding normal form; the F_1 is cloned and both F_1 and F_2 are grown amongst a standard short-strawed variety; this and all plants that deviate from the desired type are removed before flowering and selection for short straw is continued in the F_3 and later generations.

371 GLUHIH, K. A.
(Biological and agricultural characteristics of the winter rye variety Vjatka 2).
Zemledelie (Agriculture) 1959 : No. 7 : 69–70. [Russian].

Vjatka 2 was selected from Vjatka at the Agricultural Institute for northeastern districts of the Nonchernozem Belt. It outyields Vjatka by 2–3 c. per ha. and is winter hardy and fairly tolerant of flooding in the spring in the northeastern region of Russia and Siberia. Agricultural methods which promote productiveness and winter hardiness of Vjatka 2 are discussed.

372 MEDVEDEV, P. F.
(The cultural requirements of winter rye varieties in northwestern provinces).
Zemledelie (Agriculture) 1959 : No. 7 : 71–73. [Russian].

The differences in biological characteristics and cultural requirements between varieties belonging to the north Russian and the west European geographical groups are described. Gatčina and other hybrids between varieties of these two groups combine the winter hardiness of the north Russian with the large grain and other valuable characteristics of the west European ecotype. Gatčina outyields Vjatka by 3–4 c. per ha.

MAIZE

373 STEIN, O. L. & STEFFENSEN, D. M.
The activity of X-rayed apical meristems : a genetic and morphogenetic analysis in *Zea mays*.
Z. VererbLehre 1959 : **90** : 483–502.

Observations on seedling ontogeny were made on germinated maize embryos which had been subjected to different rates of X irradiation. Apart from a transient stimulation of both shoot and root growth at low rates of irradiation, typical seedling growth curves were obtained within the limits where growth was possible. The addition of indole-3-acetic acid did not alter the shapes of the curves materially nor did it increase the number of survivors at the higher rates of irradiation. An examination of the data indicated that a true assay of radiation effects can only be obtained when the ontogeny of the plant is examined at frequent intervals. Embryos which were heterozygous for yellow–green, *i.e.* with a Yg^2/yg^2 constitution, were irradiated and the number of yellow-green sectors per leaf was scored at maturity. Yellow sector results from the loss of one end of chromosome 9, and the assumption was made that each sector represents one mutation.

The first leaves to appear were present at the time of irradiation while the later leaves were produced by the shoot apex after irradiation. In most leaves the number of mutations was essentially linear with dose, but there were fewer in the later-formed leaves. The mutant sectors in these plants had to arise from the meristematic region of the apex proper and not from the primordia, as in the case of the earlier leaves. In the last-formed leaves, which originated from the apical initials, the number of sectors reached a plateau, beyond which no more were produced by additional irradiation. These results are explained on the basis of the difference between cells forming the meristematic region and the small number of "mother cells" which maintain the meristem by continued division. Only those mother cells which have not been severely damaged will contribute to the growth of the apical meristem. The data in this study indicated that the critical dose controlling the survival of these cells is about 2500 r.

An examination of the histology of the root apex indicated an all-or-none phenomenon. At sublethal doses, dead or abnormal cells were not observed, while at the critical dose the entire apex begins to collapse about six days after irradiation.

374 Kapás, S.
Hazai és külföldi hibridkukoricák összehasonlítása 1959-ben. **(Comparison of Hungarian and foreign hybrid maize in 1959).**
Magyar Mezőgazdaság, Budapest 1960 : **15** : No. 2 : 8–9 : from Hungar. agric. Rev. 1960 : **9** : No. 2 : p. 12. (Abst.).

In trials conducted at six stations in Hungary, the Hungarian hybrids Mv1, Mv39 and Mv5 were lower than some late-maturing introduced varieties, but were highest in yield of grain at a moisture content of 14%.

375 Kapás, S.
Fajtaértékvizsgálatok külföldi és magyar hibridkukoricákkal. **(Varietal trials for the evaluation of foreign and Hungarian maize hybrids).**
Növénytermelés 1960 : **9** : 1–14.

In trials of American and Hungarian hybrids in 1957 and 1958 and of Soviet hybrids in 1958, Martonvásár 1 was the best of the Hungarian varieties in yield and straw strength, but was exceeded in yield by the late American hybrids when the autumn was long and warm and in straw strength by the Soviet hybrids. Average number of ears per plant was a constant varietal character but was not related to yield.

376 **Maize breeding experiments 1958–59.**
Nyasald. Fmr. For. 1960 : **5** : No. **2** : p. 11.

In station trials the most successful double hybrid, now named Mthenga, gave an average yield 40% and 26% higher than local unselected maize and Namalenga, respectively [cf. XXX, 2341]. According to preliminary results, several double hybrids incorporating inbreds somewhat similar to those used for Mthenga are at least equal to the latter in yield and quality. Moreover, Mthenga and each of the other promising hybrids gave a higher average yield than hybrid maize from Southern Rhodesia. The local hybrids have husks completely covering the cob tip and suitable flint-type grain. They are all combinations of local, Southern Rhodesian and Mexican material. Synthetics also performed well. Mlonda, suitable for lower altitudes and possessing good resistance to *Puccinia polysora*, showed little deterioration in yield when the seed was grown for a second year [cf. *loc. cit.*]. Asikari, a synthetic suited to most of the main maize-growing areas of the territory, gave high yields of good-quality grain on a field scale and in variety trials at several centres.

377 Grobman, A., Paulette, M. & Scheuch, F.
Variedades e híbridos de maíz para la Costa del Perú. **(Maize varieties and hybrids for the coastal region of Peru).**
Bol. Program. coop. Invest. Maíz, Perú 1960 : No. 1 : Pp. 12.

Details are given of the origin, maturity period, water requirement and area of adaptation of maize varieties grown in the coastal region of Peru. In yield trials conducted at several centres, the hybrids PM211 and PMT–234 proved outstanding.

378 **What's ahead in corn research.**

Agric. Res., Wash. 1960 : **9** : No. 3 : 8–9.

Some fundamental investigations now being carried out in the USA on the genetics, physiology and pathology of maize are singled out for a brief survey on account of their immediate potentialities for practical application in the improvement of the crop.

379 GIESBRECHT, J.

The inheritance of time of silking and pollen shedding in maize.

Canad. J. Genet. Cyt. 1959 : **1** : 329–38.

A study has been made of the manner of inheritance of maturity in hybrid maize as measured by days to silking and days to pollen shedding. The trial was carried out on the progeny of the cross between two inbred lines V3 and B14. The former is a very early-maturing line originating in Manitoba while B14 is a late-maturing line from Iowa. Individual plant data were taken on the parental inbreds, their F_1 and F_2, and on the back crosses of the F_1 to each parent. Results indicated the presence of partial phenotypic dominance for earliness and of interallelic interaction of maturity factors. A genetic analysis using the partitioning method suggested that for days to pollen shedding, the two inbreds differed by five genes. For days to silking, the evidence was not clear but suggested either a four or a five-gene difference.

High estimates of heritability were obtained for both measures of maturity. This indicates that the differences in the environment normally found within a plot have little effect on the expression of maturity. Thus, selecting for early-maturing plants in the segregating population of this cross should be effective in retaining the earliest genotype.

380 BRINK, R. A., BLACKWOOD, M. & NOTANI, N. K.

Effects of structural changes in the long arm of chromosome 10 in maize on paramutation of the R^r factor.

Science 1960 : **131** : p. 1317. (Abst.).

"Three reciprocal translocations involving, in each case, a break in the long arm of chromosome 10, two proximal and one distal to the R locus and removed from the latter by at least 5 to 10 crossover units, if in coupling but not repulsion with R^r, (i) increase the aleurone pigment-producing action of R^r from dark mottling to near self-color, in single dose, and (ii) render R^r comparatively insensitive to paramutation in stippled R^r heterozygotes (TR^r/R^{st} or R^rT/R^{st}). Insertion of R^{st} in a translocation (T) chromosome has little or no influence on the strong paramutagenic action of this allele in heterozygotes with R^r on a normal chromosome (TR^{st}/R^r). The effects, under (i) and (ii), seemingly appear only after a lag of at least one generation following introduction of R^r into a T chromosome. Such germinally transmissible changes in R^r action, once induced in a TR^r/r^r plant, invariably persist for at least one generation following return of R^r from a T to a structurally normal chromosome by crossing over. This fact excludes conventional position effect as an explanation of the phenomenon. For reasons not at present apparent, R^r in coupling with a translocation (TR^r) is somewhat lower in pigment-producing action, and is more sensitive to paramutation in R^{st} heterozygotes, when derived from TR^r/R^r (homozygous colored) than from TR^r/r^r (heterozygous colorless) plants. The evidence from these experiments suggests the occurrence of functional components of the chromosome much larger than individual loci." [Cf. XXIX, 3368].

381 SARMA, M. S.

Studies on the origin of the non-crossover derivatives from the A^b complexes in maize.

Diss. Abstr. 1959 : **20** : LC Card Mic 59–4563 : p. 1551. (Abst.).

"Noncrossover pale cases from the A^b: Peru and A^b: Ecuador complexes in maize were analyzed for the presence of a separable element β_0, the null level form of β resulting from the postulated intragenic mutation of β. Crossover stable and crossover mutable pale cases from the two sources were included in the experiment as controls. The former are known to lack the β-carrying segment while the crossover mutable α cases presumably have the a: standard element at the site of β. All three classes of pale derivatives were crossed by A^b or A and the resulting F_1 heterozygotes were backcrossed by a. Colourless cases (a^*) occurring on the backcrossed ears were analyzed for their marker relations, for mutability under the influence of Dt_1, and for pericarp reaction.

"Recombinant a^* derivatives are recovered from crossover mutable α: P in very low frequencies; these a^* cases are mutable and show recessive or dominant brown pericarp effect. The low frequency of crossover a^* cases from the mutable α: P source suggests that the a: standard element may not occupy the site of

β. No a^* cases of crossover origin have been recovered from the noncrossover and the crossover stable α:P isolates. This suggests that the noncrossover α:P isolates are structurally similar to the crossover stable α:P cases and that they therefore lack the postulated β_0 element.

"Colourless derivatives of crossover origin are recovered from all three classes of pale cases from A^b:Ec with about equal frequencies. Whereas the a^* cases from the crossover stable and the noncrossover α:Ec pale cases are stable, those from the crossover mutable α:Ec are mutable. These results suggest that the noncrossover pale isolates are similar to the crossover stable α:Ec cases and that the colourless element isolated here by crossing over is not synonymous with β_0, and is situated closer to α than is β in the parental A^b complex. It is further suggested that the a:standard element of mutable α:Ec may not occupy the original site of β.

"Thus intragenic mutation of β to the postulated null level element β_0 does not appear to be responsible for the production of noncrossover α derivatives from either A^b:P or A^b:Ec.

"The noncrossover a^* derivatives derived from mutable α sources are mutable, whereas those from the other two sources are stable. They are associated with dominant or recessive brown pericarp effect. The nature of the crossover and the noncrossover a^* derivatives suggests that an element designated a^{db}, determining dominant brown effect, and another element designated a^{rb}, associated with recessive brown pericarp, are members of the A^b complexes. The data suggest that for A^b:Ec the linear order of components is centromere:α:a^{db}:a^{rb}:β, and that the order of elements in the A^b:P complex is centromere:β:a^{rb}:a^{bd}:α."

382 Greenblatt, I. M.

The genetic composition of twin mutations in medium variegated pericarp of maize.

Diss. Abstr. 1959 : **20** : LC Card Mic 59–5773 : p. 1977. (Abst.).

Mutations for red and light variegated pericarp and cob often occur as twin spots in medium variegated ears [cf. XXVII, 1725]. According to an earlier hypothesis, such a twin spot results from a mitosis which is differential at locus *P*, the assumption being made that the *Mp* component lost from one daughter nucleus (red phenotype) as a result of transposition from *P* becomes transferred along with an unchanged P^{vv} $(\overline{P^{rr}Mp})$ allele, to the other daughter nucleus (light variegated). Tests have however revealed that twin spots are not homogeneous in this respect, but fall into two classes as regards presence or absence of *tr–Mp* in the red sector. The author has investigated twin mutations containing *tr–Mp* in the red sector. It is postulated that twin mutations result from a single transposition of *Mp* during the time of chromosome replication, P^{rr} and its conjoined *Mp* replicate at *P* producing two $\overline{P^{rr}Mp}$ complexes, prior to replication of certain other portions of the chromosomes. An *Mp* from one of the daughter $\overline{P^{rr}Mp}$ complexes transposes to an unreplicated site and then replicates in synchronization with that chromosome region. The resulting daughter nuclei would then be of two genotypes: (1) P^{rr} + *tr–Mp* (red) and (2) $\overline{P^{rr}Mp}$ + *tr–Mp* (light variegated). If this interpretation is valid, it may be expected that *tr–Mp* would be situated at the same locus in red and light variegated sectors of a twin. The following evidence was obtained in support of this hypothesis. A three-point linkage analysis was employed to test the linkage relations of *tr–Mp* in a series of twins, the markers being *tr–Mp*, *P* and the breakage point of a reciprocal translocation. Transposed *Mp* proved to be at the same chromosome site in both sectors of four twins tested. Transposed *Mp* was linked distally with *P* in three twins and proximally with *P* in another, and in two others segregated at random. The *tr–Mp* sites differed in position in at least five of the six twins.

383 Lebedeff, G. A.

Further studies on the inheritance of loose pericarp in corn.

J. Hered. 1960 : **51** : 15–18.

The inheritance of loose pericarp was further studied [cf. XXIX, 1514] in crosses between the inbred line Mpl and a variety referred to as Flint, and between Mpl and two other inbred lines, Tx203 and GE129. Flint has a smooth pericarp, but the other three lines in the trial all possess a loose pericarp.

Smooth pericarp of Flint was found to be dominant over loose pericarp of Mpl, and it appeared that three genes were involved in differentiating grades of pericarp in crosses between the two varieties. The results of Tx203–Mpl and GE129–Mpl crosses indicate that although these three inbred lines have loose pericarp, they differ genetically. Some smooth grades of pericarp appeared in the F_2 of these crosses; this indicates that the inbred lines carry some modifying genes for loose pericarp which are dominant over those for smoother grades.

384 Oltmann, W.
Deutsche Hybridmaise. **(German hybrid maizes).**
Mitt. dtsch. LandwGes. 1960 : **75** : 513–15.

The first hybrid maize varieties bred in Germany, released in 1960, give mean grain yields 30% above those from open-pollinated varieties of corresponding maturity class; in one test in Bavaria the hybrids gave an average grain yield of 69·5 c. per ha. compared with the local variety Dr. Delilles neue Kreuzung [Dr. Delille's New Cross], a difference of 44%. Hybrids from other countries are mostly too late and not hardy enough in German conditions.

385 O melhoramento do milho em Portugal. **(The improvement of maize in Portugal).**
Agricultura, Lisboa 1959 : No. 2 : 41–45.

A general survey is given of the development of hybrid maize in Portugal under the auspices of FAO.

386 Beiträge über die Maiskultur. **(Contributions on maize growing).**
Schweiz. landw. Z. 1960 : **88** : 488–506.

The maize varieties and hybrids grown in Switzerland are classified according to maturity period and yield and an outline is given of the maize-breeding operations in Switzerland since 1949. From crosses of 80 single-cross hybrids from the USA with Rheintaler and other Swiss types, the hybrid Orla 266 was selected as the best and released in 1955. It is slightly earlier than Rheintaler and Wisconsin 270 and in grain yield exceeds the former by 40% and the latter by 20–25%. Other hybrids are now available which can replace Orla 266 in favourable and unfavourable areas respectively and also for ensilage. The best of the newer hybrids exceeded Orla 266 by 16% in grain yield in 1959, a very favourable year; others were equal in yield but ripened a few days earlier.

The best late-ripening silo maize so far has proved to be Ohio M34, which is replacing Nostrano dell'Isola; among the early silo varieties Orla 266 is still the best.

Improvements are being effected also in standing capacity, winter hardiness and resistance to smut and other diseases and pests. The hybrids recommended for growing in 1960 are listed and described.

387 Popow, G.
Maishybriden für den Anbau 1960. **(Maize hybrids for growing in 1960).**
Mitt. schweiz. Landw. 1960 : **8** : 58–64.

A number of hybrids, most of them produced in Switzerland, are recommended for different localities in Switzerland and for different purposes and described.

388 Agble, W. K.
Corn growing and facts concerning the new hybrid releases to farmers in southern Ghana.
Ghana Frmr. 1960 : **4** : 53, 56–57.

Details are given of two new synthetic maize hybrids bred in Ghana, GS1 and GS2. They are generally superior to local nonhybrid varieties in important characteristics such as seedling vigour, yielding ability, earliness, rust tolerance, nutritional value, palatability and resistance to lodging. They are suitable for cultivation in all parts of Ghana except the northern region.

389 **New corn hybrid for Pennsylvania.**
Crops & Soils 1959 : **12** : No. **3** : p. 20.

Pa. 215 is an early variety best adapted to northern Pennsylvania where late-summer frosts are possible. It has strong roots and stalks and is resistant to leaf aphids and to *Pyrausta nubilalis*. The ears are long and resistant to rots. In Pennsylvania the hybrid has outyielded Wis. 275; it is also more drought resistant.

390 Thomas, W. I., Gorsline, G. W., Korman, G. W., Ragland, J. L. & Wernham, C. C.
1959 Pennsylvania corn performance studies.
Progr. Rep. Pa. agric. Exp. Sta. 1960 : No. 220 : Pp. 17.

A summary is given of the performance of inbreds and hybrids involved in the 1959 experiments carried out by the Pennsylvania State University.

Data are included on two normal hybrids and their dwarf counterparts grown at six different densities of population. Dwarfs gave lower yields, as has been generally found elsewhere. Whether the yield depression is the effect of Br_2 *per se* or is due to deleterious linked factors simultaneously brought into converted inbreds has not been ascertained. Introduction of the gene for dwarfing into segregating populations, followed by normal selection and testing of dwarf inbreds, may be a more satisfactory approach to the development of dwarf hybrids than conversion of standard inbreds by back crossing.

391 JUGENHEIMER, R. W. & WILLIAMS, K. E.
Illinois inbred lines of corn released in 1960.
Bull. Ill. agric. Exp. Sta. 1960 : No. 657 : Pp. 16.

Information is given on inbreds released by the Illinois Agricultural Experiment Station, together with data for predicting double-cross performance from three-way combinations.

392 MARTIN, A. G.
Hybrid maize varieties.
Qd. agric. J. 1960 : **86** : 158–60.

The hybrids Q790, Q724 and DS303 have consistently outyielded all other early and midseason varieties in the southern Darling Downs, Queensland.

393 SALAMOV, A. B.
(The breeding of early hybrids for northern districts of the USSR).
Kukuruza (Maize) 1959 : No. 7 : 42–44. [Russian].

An account of breeding forage types of maize with growth periods adapted to Moscow conditions in North Osetia is given. The crosses were made mostly between early varieties such as Voronež 76 and single crosses from the Institute of Plant Industry (VIR). The results include Osetian 1981 [Voronež 76 x (VIR 40 x VIR 41)], which is more productive of grain and forage than Sterling under Moscow conditions. Its growth period is intermediate between Voronež 76 and Sterling.

394 MALYHINA, V. F.
(Presowing treatment of hybrid seed with a boric acid solution).
Kukuruza (Maize) 1959 : No. 7 : 23–24. [Russian].

Soaking maize seed in aqueous solution of boron promoted the development of reproductive organs of the plants, improved pollen viability and increased the amount of fertile pollen in experiments at Luganskoe. Data are given on the grain yields of a few varieties and hybrids raised from soaked seed in two seasons with different meteorological conditions. Information is also provided on yield increases of hybrid VIR42 [Institute of Plant Industry 42] whose parental forms were raised from soaked seed. The yields also rose when the pollen parent had been raised from soaked seed. Presowing treatment of the F_1 seed resulted in an appreciable improvement of grain yield in the F_2 of VIR 42 and hybrid Slava [Glory], by comparison with the corresponding F_2 from untreated F_1 seed.

395 JONES, D. F.
The genotype as the sum of plasmatype and chromotype.
Amer. Nat. 1960 : **94** : 181–83.

Examples of cytoplasmic inheritance in maize and other organisms are mentioned. It is thought that it is now necessary to extend genetic terminology to include both chromosomal and nonchromosomal hereditary material. A list of the terms used in the literature for hereditary units is provided for consideration and it is pointed out that the terminology does not provide for nonchromosomal nuclear factors.

396 JONES, D. F., STINSON, H. T. & KHOO, U.
Plasmatypes of maize as evidence of cytoplasmic diversity and continuity within a species.
Science 1960 : **131** : p. 1318. (Abst.).

"In *Zea mays* three different types of cytoplasm have been found. These types are separated by their interaction with known genes to produce either normal or aborted pollen. These cytoplasmic differences have persisted without alteration during 15 generations of backcrossing and presumably have existed for very long periods of time. This raises two questions which have not yet been answered: Have these different plasma-types been derived from the different species that have presumably contributed to cultivated maize as we now know it? Or have the plasmagenes mutated since the species was established? This has an important bearing on the origin of cytoplasmic differences and the differentiation and separation of species."

397 EMMERLING, M. H.
The mutational behavior of the R^r: Jana allele in *Zea mays*.
Genetics 1960 : **45** : 763–69.

In contrast to the separate seed and plant colour components (*S*) and (*P*) existing within the *R* segment of R^r: Cornell [cf. XXIX, 3369], a large proportion of the mutants from R^r: Jana were of the type expected if (*P*) and (*S*) were a single entity with two kinds of action.

The single condition could not however be definitely established since a small proportion of mutants were of the type expected from the action of two independent components.

398 Sprague, G. F., Russell, W. A. & Penny, L. H.
Mutations affecting quantitative traits in the selfed progeny of doubled monoploid maize stocks.
Genetics 1960 : **45** : 855–66.

A detailed study of the S_3–S_6 progenies of a series of doubled monoploids revealed significant differences between parent and progeny means for each of the following characters: plant height, leaf width, number of tassel branches, number of kernel rows, ear length and diameter, 100-kernel weight, weight of shelled grain per plant and date of silking. Significant differences were interpreted as resulting from some type of mutational change and the rate observed was 4·5 mutations per character per 100 gametes tested. The various factors that might influence the reliability of the observed mutation rate are discussed.

399 Thomas, W. I.
Two new field corn hybrids available to farmers in 1961.
Sci. Fmr., Pa. 1960 : **8** : No. **1** : p. 3.

Pa. 290 is a high-yielding, drought-resistant line with strong stalks and roots and is resistant to leaf aphids and *Pyrausta nubilalis*; it also has some resistance to northern and southern leaf blight.

Pa. 475 equals Pa. 444 in resistance to *Helminthosporium* and *Pyrausta*, is drought resistant and shows above-average resistance to leaf aphids. It is intended as a replacement for Pa. 444. The new hybrids are being released by the Pennsylvania State University Agricultural Experiment Station.

400 Gooding, H. J.
Yields of West Indian maize.
Trop. Agriculture, Trin. 1960 : **37** : 257–64.

Farm Corn, developed at the Imperial College of Tropical Agriculture through mass selection, is a tall, vigorous variety, relatively high-yielding, mainly dent and with mixed yellow and orange endosperm. Trials in Trinidad have shown that the yield of several Caribbean races is generally lower than that of top crosses of these races with Farm Corn. It is suggested that more attention should be paid in the West Indies to indigenous races and to the top-cross method of improvement.

401 Ramírez E., R., Timothy, D. H., Díaz B., E. & Grant, U. J.
Races of maize in Bolivia.
Publ. Nat. Acad. Sci. Washington 1960 : No. 747 : Pp. 159.

On the basis of the same characters as were used in earlier work [cf. XXIII, 1158 and XXIX, 1497], 844 collections of Bolivian maize were classified into 32 distinct races. General descriptions, tabular data on ears, plants and tassels, internode diagrams, ear cross-section diagrams, distribution maps and ear photographs are presented for each race. Less attention than in previous studies is devoted to the origin and relationships of the races, the reason being the lack of information on inbreeding and crossing behaviour.

Cytological studies on 18 races showed that the highland races form an extremely homogeneous group in so far as their chromosome knob constitution is concerned; only one Andean popcorn race, Pisankalla, did not conform to the pattern. The lowland races, on the other hand, showed far more variability in knob number and position; they also had less B type chromosomes than the highland races.

It is pointed out that an understanding of local varieties is an essential prerequisite to maize improvement in ancient centres of maize variability such as Bolivia. It is also suggested that certain Bolivian races, whose evolutionary history differs greatly from that of the common maize of the US Corn Belt, may provide critical material for the investigation of certain problems of heterosis.

402 Ibrahim, Mahmoud A.
A survey of chromosome knobs in maize varieties.
Genetics 1960 : **45** : 811–17.

Tabulated information is given on kernel type, size and row number, and chromosome knob number in 150 maize varieties from world sources and 6 local varieties. Knob number ranged from zero to eight and plants of a single variety from different sources varied in knob number and agronomic characters. No variety having more than three knobs was found in material from regions north of latitude 40°. High knob number was positively correlated with large kernel size and may also be associated with denting and with high kernel-row number. Observations on *Euchlaena perennis* and a local *E. mexicana* population showed the former to have seven large and six smaller knobs of which eight were terminal, and the latter to have nine large knobs of which six were terminal.

403 MAGUIRE, M. P.
A study of homology between a terminal portion of *Zea* chromosome 2 and a segment derived from *Tripsacum*.
Genetics 1960 : **45** : 195–209.

The material studied comprised disomic plants heterozygous for a *Zea-Tripsacum* interchange chromosome 2, in which the segment derived from *Tripsacum* was equal in length to the portion of maize chromosome 2S for which it had been exchanged. The *Tripsacum* segment carried loci normally present in this region and was marked by a terminal knob. Genetic recombination between the corresponding maize and *Tripsacum* segments was very rare. These segments were commonly paired at pachytene, but a variable amount of failure in pairing between them was found in about 7% of the microsporocytes. Unexpectedly large amounts of terminal pairing at pachytene were detected for each of the other chromosomes of the complement, the average being about 3% per chromosome end. The extent and frequency of failure for the region known to be heterozygous for the maize and *Tripsacum* segments were however markedly in excess of the amount of failure for all others. Ten apparently normal bivalents were present at diacinesis and metaphase I. Relative chromosome length was positively and significantly correlated with frequency and extent of failure in pairing. Stage of pachytene advancement, as measured by total length of chromosomes, was negatively and significantly correlated with extent and frequency of pairing failure. It is suggested that much of the pairing failure may have been the result of irregular dissociation of homologous parts in a slightly unbalanced chromosome complement. Caution is advocated in interpreting isolated observations of failure in pairing as being indicative of lack of homology. It is also suggested that most or all the material previously referred to as belonging to the zygotene stage may represent erroneously interpreted synaptic failure or precocious opening of previously synapsed chromosomes, and that synapsis may as a rule occur during the period traditionally considered to be premeiotic interphase. It is pointed out that the hypothesis of the occurrence of crossing over during chromosome duplication would be rendered more plausible if synapsis does in fact take place during interphase.

404 MAGUIRE, M. P.
A study of pachytene chromosome pairing in a corn-*Tripsacum* hybrid derivative.
Genetics 1960 : **45** : 651–64.

Trivalent configurations at pachytene were analysed in 21-chromosome plants of two types. In the first type ["knob (+)"], two reciprocal interchange chromosomes were present, one being a maize chromosome 2 with a terminal knob-bearing segment from *Tripsacum* in the distal region of its short arm, and the other a *Tripsacum* chromosome with the distal region of the short arm of maize chromosome 2 in its long arm. In the second type ["knob (−)"], two normal maize chromosomes 2 were present, the extra chromosome being the same as the *Tripsacum* chromosome in the first type. The mean percentage of the total length of chromosome 2 paired with the extra *Tripsacum* chromosome in trivalents was significantly greater in knob (+) (20·2%) than in knob (−) plants (14·6%). Variances for measurements of this length in the two types of plants did not differ significantly. At the point of partner exchange most trivalents involved a region, usually short, where all chromosomes were unpaired. A significant negative correlation was detected between the extent of this region and the absolute length of maize chromosome 2; the trivalents may therefore have been progressively opening in this region as pachytene proceeded. From data on knob (+) plants, the extent of normal chromosome 2 replaced by a *Tripsacum* segment of the same length from the extra chromosome was estimated as about 24–25% of its total length. The theoretical implications of the results are discussed in relation to general problems of synapsis.

405 KREIZINGER, J. D.
Diepoxybutane as a chemical mutagen in *Zea mays*.
Genetics 1960 : **45** : 143–54.

Investigations which have already been briefly reported are described in detail [cf. XXIX, 3823].

406 GÖRING, H.
Untersuchungen zum Befruchtungsprozess bei *Zea mays* L. mit radioaktivem Phosphor. (**Studies of the fertilization process in *Z. mays* L. with radioactive phosphorus**).
Naturwissenschaften 1960 : **47** : p. 142.

Studies conducted at Moscow University showed that, ten days after fertilization with P^{32} labelled pollen, cross-pollinated ovules contained about twice as much P^{32} as selfed ovules. Since preliminary experiments with inviable radioactive pollen had shown that P^{32} appears in the ovules almost exclusively as a result of pollen-tube growth, it could be calculated from the amount of P^{32} present that an average of 4·7–9·2 pollen-tubes had reached each cross-pollinated ovule. It is thought that the number of pollen tubes directly affects the vigour of the offspring and that it may thus be possible, by stimulating pollen-tube growth, to improve the vigour of inbred progenies.

407 GIESBRECHT, J.
The inheritance of maturity in maize.
Canad. J. Pl. Sci. 1960 : **40** : 490–99.

The inheritance of maturity, as measured by days from seeding to silking and from seeding to pollen shedding, was studied in two inbred lines, Mt42 and WF9, their F_1 and F_2 and the back crosses of the F_1 to both parents. Mt42 is a very early-maturing line selected in Minnesota, while WF9 is a late-maturing line from Indiana. Data were collected over a 2-year period on an individual plant basis. Information on dominance and gene interaction was obtained by comparing the observed means with the calculated means, the latter being obtained using the formula given by Powers [cf. XXVI, 2911]. The results indicated the existence of partial phenotypic dominance for earliness. Heritability estimates were very low, probably owing to the fact that the formulae used to calculate them are based on the assumption of additivity of gene effects; such additivity does not appear to apply in the case of the factors governing the two characters studied. Genetical analysis of the two characters by the partitioning method indicated that Mt42 and WF9 differed by four effective factors and that all the factors for increased earliness were located in the Mt42 line. A genetical model is presented which appears to satisfy the data for both characters.

408 ZUBER, M. S., DEATHERAGE, W. L., MACMASTERS, M. M. & FERGASON, V. L.
Lack of correlation between the amylose content of pollen and endosperm in maize.
Agron. J. 1960 : **52** : 411–12.

An analysis of seven cultures with an amylose content of the endosperm starch ranging from 0 to 75% was undertaken to discover whether it would be possible to identify desired plants by rapid pollen analysis in breeding maize with high amylose content. No significant relationship was however found between amylose percentages in the endosperm starch and pollen starch or between the protein percentage in the defatted endosperm and the pollen.

409 SAWADA, Y.
(Physiological and morphological studies on pollen grains. XVIII. Nitrogen metabolism of maize pollen).
Shokubutsugaku Zasshi/Bot. Mag., Tokyo 1960 : **73** : 252–57. [Japanese].

The germination rate of maize pollen on 15% sucrose agar was greatly improved by the addition of small quantities of aminoacids. The most effective single additions were aspartic acid, glutamic acid and cysteine. Of the double additions, aspartic acid + glycine and aspartic acid + threonine were better still. The aminoacid content of the flowers was found to rise to a maximum about the time of anther dehiscence.

410 WALDEN, D. B.
Preliminary studies on longevity of corn pollen and related physiological factors.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–622 : 3488–89. (Abst.).

Longevity of maize pollen was influenced by storage temperature and moisture content of the pollen at the beginning of storage treatment. Viability could be maintained for 200 hr. in samples stored at temperatures between − 8° C. and 5° C.

411 MURDY, W. H.
The strengthening system in the stem of maize.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–5263 : 1993–94. (Abst.).

An analysis was made of the sclerotic tissue in maize, *Euchlaena* and *Tripsacum* and of its variation within and among six races of maize. Intraracial differences were slight in comparison with interracial ones. Interracial variation consisted of differences not only in amount of sclerotic tissue but also in its distribution. Races also differed in the way in which the structural anatomy of the stem changed during growth, such change being related to the growth behaviour characteristic of each race. A race with uniform rate of growth showed only slight, gradual alterations in anatomy from one internode to the next, whereas one with a rapid initial rate of growth, which was abruptly slowed down above the position of the ear shoot, had a correspondingly sudden alteration in anatomy. The classification of races according to overall development of sclerotic tissue was in agreement with their ranking for ability to remain standing after final maturation and desiccation.

412 de Muelenaere, H. J. H. & Quicke, G. V.
The possibility of using *Tribolium castaneum* as test organism for evaluating the relative nutritive quality of different samples of maize.
S. Afr. J. agric. Sci. 1960 : **3** : 137–38.

Samples of the maize Teko Yellow from exhausted soil (T_1), from manured soil (T_2) and from soil treated with inorganic fertilizer (T_{25}) were assayed by means of the storage pest *T. castaneum*. The length of the larval period was significantly greater on T_{25}, and almost significantly greater on T_2, than on T_1. The values agreed well with values obtained from assays with rats.

413 Grafius, J. E.
Does overdominance exist for yield in corn ?
Agron. J. 1960 : **52** : p. 361.

The writer expresses the view that if, as has been found in barley, yield components in maize are not correlated, overdominance for yield cannot occur and the evidence given in favour of overdominance has in reality a geometric interpretation.

414 Kovács, M.
Szükség van-e külön silókukorica fajtára? **(Is there a need for special silage maize varieties ?).**
Magyar Mezőgazdaság, Budapest 1960 : **15** : No. 2 : 10–11 : from Hungar. agric. Rev. 1960 : **9** : No. 2 : p. 12. (Abst.).

In an irrigated trial conducted at the Hungarian Research Institute for Irrigation and Rice Growing, dry matter yield was higher in varieties bred for silage than in those bred for grain. Varieties behaved differently in response to reduced spacing.

415 Schick, R., Engel, K.-H. & Raeuber, A.
Über die Phänometrie des Maises. **(Phenometry of maize).**
Züchter 1960 : **30** : 97–101.

Daily measurements of the leaves and inflorescences were made on 20 or more plants of the maize 'Bernburger Fettmais' [Bernburg Oil Maize] in two locations, one exposed and the other protected. The figures show that differences in growth at the two locations could be accounted for to 35% by temperature, 43% by wind velocity and 22% by soil humidity, the optima being given as 22–25° C. for day and 18° C. for night temperature, wind velocity between Beaufort 0 and 1 and soil humidity 20%. In most areas of the German Democratic Republic the mean summer temperatures are below these optima and breeding must be directed towards varieties that suffer least from the effects of suboptimal temperatures.

416 Ventura, Y.
Inheritance studies of the cold test reaction of *Zea mays*.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–6045 : 1985–86. (Abst.).

The cold-test reactions of the "reciprocal F_1, F_2, F_3 backcross and selfed backcross populations," derived from a cross between inbreds M14 and A334 were determined in a two-year trial. Significant differences between the two inbreds and between all crossed and selfed populations derived from them were found with respect to ability to germinate at low temperatures. Such differences, detected by the Hoppe wet-towel technique, were apparently maintained from year to year, as suggested by a highly significant interannual correlation (+ 0·694). As indicated by observations on stand, the maternal effect upon cold-test reaction was on the average greater than the paternal, both effects and the ♂ x ♀ interaction being highly significant. The maternal effect was in most cases attributable to the double genetic contribution of the ♀ parent to the endosperm and in a few others to the influence of the pericarp or to cytoplasmic differences. Two-gene models based on the endosperm or embryo genotype were devised to illustrate a few of the possible modes of gene action responsible for inheritance of cold-test performance. The best fit to the observed population means was obtained with the overdominance model based on endosperm genotypes, but none of the models was satisfactory as a means of explaining the ratios derived from the selfed back-cross populations. "Predicted values for the segregating populations ($F_2{}^x$ and F_3 lines) variance were arrived at by setting up a model based on the phenotypic mean values of the genotypes of P_1, P_2, $P_1 \times P_2$, and $P_2 \times P_1$." Only part of the predicted values agreed with the corresponding actual variances. It thus appeared that inheritance of cold-test performance was complex. Study of 20 parental ear cultures originating from inbreds M14, A334, A206 and Oh51A revealed that sublines within an inbred did not generally differ from one another. Disparities between ears within sublines were however significant. Differences due to field-replication effect were often highly significant, as were also entry x replication and entry x year x replication interactions.

417 Koehler, B.
Cornstalk rots in Illinois.
Bull. Ill. agric. Exp. Sta. 1960 : No. 658 : Pp. 90.

This comprehensive review of published research includes details of some previously unreported trials involving two of the most common causal agents of corn stalk rots, *Diplodia zeae* and *Gibberella zeae*. Data were obtained in 1957 on the extent of natural infection by these two fungi in nine single crosses. The results indicated that while there was a strong tendency for the reaction to these two fungi to be similar, occasional inbreds reacted in an opposite manner to the two pathogens. Artificial inoculation was employed in a 1952 trial; it was demonstrated that two single crosses, WF9 x Hy2 and Ky27 x 33–6, reacted quite differently to the two fungi. Artificial inoculation was also used in a 1957 experiment with nine single crosses. The results showed a lack of uniform association for resistance to *D. zeae* and *G. zeae*.

418 Kramer, H. H. & Ullstrup, A. J.
Preliminary evaluation of exotic maize germ plasm.
Agron. J. 1959 : **51** : 687–89.

From preliminary tests with 1066 introduced maize varieties, sources of resistance to *Puccinia sorghi*, *P. polysora*, *Helminthosporium turcicum* (*Trichometasphaeria turcica*) and *H. maydis* (*Cochliobolus sativus*) were isolated.

Self pollination of 2606 ears revealed a large number of endosperm and seedling mutants. Of 572 varieties crossed with the widely grown hybrid Wf9 x Hy, only 8 of the progenies yielded significantly more than the hybrid and all of these matured appreciably later.

419 Jermoljev, E., Staněk, M. & Ujevič, I.
Studium možnosti zjištění odolnosti odrůd kukuřice proti původci sněti kukuřičné—*Ustilago zeae* (Beckm.) Unger sérologickými metodami. [**A study of the possibilities of ascertaining the resistance of maize varieties to the causal agent of maize smut, *U. zeae* (Beckm.) Unger, by serological methods**].
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1067–78.

One of the two serological methods used gave results closely agreeing with those of field tests and this method is recommended for use in selecting for resistance to *U. zeae*.

420 Guthrie, W. D., Dicke, F. F. & Neiswander, C. R.
Leaf and sheath feeding resistance to the European corn borer in eight inbred lines of dent corn.
Res. Bull. Ohio agric. Exp. Sta. 1960 : No. 860 : Pp. 38.

A detailed account is provided of the procedures and results of tests which have been briefly described elsewhere [cf. XXIX, 3842].

421 Peters, D. C., Zuber, M. S. & Fergason, V.
Preliminary evidence of resistance of high-amylose corn to the Angoumois grain moth.
J. econ. Ent. 1960 : **53** : 573–74.

Using maize kernels with amylose contents ranging from 0% to 75%, it was found that, on high-amylose maizes, *Sitotroga cerealella* larvae grew more slowly, fewer of them reached the adult stage, and the adults weighed less than moths grown on normal maize (about 27% amylose).

422 Singh, B. & Paliwal, R. L.
Studies on a luxuriant form of teosinte and its hybrids with maize.
Agra Univ. J. Res. 1960 : **9** : 137–46.

Developed from a single plant found in a botanical garden in Agra, BRC teosinte is very luxuriant in vegetative growth, adult plants having a mean height of 14·55 ft., with 9·06 tillers per plant. It is similar in several characteristics to Jutiapa, one of the south Guatemalan teosintes. Hybridization with maize was found to occur readily but in the F_2 some irregularities, such as univalents and heteromorphic pairs, were observed during meiosis.

In both BRC and its hybrids with maize, sown in February or March and blooming in June, an interesting form of vegetative reproduction was observed. The staminate inflorescences developed into vegetative propagules, which, when planted in the soil, formed healthy, independent plants. The possibilities of BRC teosinte as a fodder crop are discussed.

423 Ting, Y. C.
Cytological observations on two tropical forms of *Tripsacum*.
Bot. Mus. Leafl. Harv. 1960 : **19** : 97–107.

Chromosome number and morphology and meiosis are described for samples of the two

Colombian species *T. laxum* and *T. australe*. *T. laxum* had 54 chromosomes whose irregular meiotic behaviour suggested triploidy originating from hybridization between tetraploid *T. laxum* and an unknown diploid. In *T. australe*, in which $2n = 36$, meiosis was regular.

BARLEY

424 Société d'Encouragement de la Culture des Orges de Brasserie et des Houblons en France. Rapports sur la campagne 1958. (**Society for the Promotion of the Cultivation of Malting Barley and Hops in France. Report for the year 1958**). 1958 : Pp. 71.

The results of barley varietal trials conducted at various centres throughout France are reported; analyses of malting quality are included. The performance of some recent hybrids is briefly mentioned.

425 Rasmussen, F.
Sortsforsøg med byg 1947–1956. (**Varietal trials of barley, 1947-1956**).
Tidsskr. Planteavl 1960 : **64** : 77–101.

Data are given on the yield and response to nitrogen of a total of 15 varieties tested at 12 stations in Denmark for varying lengths of time during the above period.

426 Wintergerst, 1960. (**Winter barley, 1960**).
Landbouwvoorlichting 1960 : **17** : Bijl. 72; Ber. Rassenkeuze No. 289 : unpaginated.

Results of interprovincial trials held in the Netherlands since 1951 are presented. Dea was productive on all soil types and LBW1007–7, which is still undergoing preliminary testing, has shown promise.

427 Grafius, J. E. & Adams, M. W.
Eugenics in crops.
Agron. J. 1960 : **52** : 519–23.

Some of the difficulties associated with the selection of parents in self-fertilized crops and either parents or recombining lines in cross-fertilized species are discussed. One difficulty is the apparent need to consider several economic characters at once. A vector model is proposed whereby it appears possible to predict the best parents and combinations of parents to produce progenies which have means approaching an ideal for a large number of traits. This in effect is an attempt to make the progeny mean coincide with an ideal for a large number of traits. The model which has been presented for examination is based on 13 traits for 18 barley varieties but it is applicable to both self-fertilized and cross-fertilized species.

428 Nilan, R. A.
Barley research at Washington State University.
Sverig. Utsädesfören. Tidskr. 1960 : **70** : 110–16.

A brief survey of genetical and breeding research in progress is presented.

429 Gärtner, K.
Kétsoros őszi árpa. (**Two-rowed winter barley**).
Söripar. Budapest 1959 : 235–38 : from Hungar. agric. Rev. 1960 : **9** : No. 2 : p. 12. (Abst.).

Two two-rowed winter barleys and one two-rowed spring variety, recently developed in Hungary, have proved satisfactory in malting and brewing quality in trials in Hortobágy.

430 Murty, G. S. & Jain, K. B. L.
Genetic studies in barley. II. Inheritance of fertility of the lateral florets and certain other characters.
J. Indian bot. Soc. 1960 : **39** : 281–308.

In *H. vulgare* x *H. distichum* crosses, lateral floret fertility was conditioned by a single gene in K251 x EB438 and by two genes in EB171 x EB417 and EB177 x EB417. In *H. vulgare* x *H. deficiens* crosses, inheritance was monogenic. Hooded lemma, long glume awns, broad leaves, semispreading early growth habit and early heading date were all monogenically conditioned and dominant [cf. XXX, 3928].

431 Wagenaar, E. B.
The cytology of three hybrids involving *Hordeum jubatum* L.: the chiasma distributions and the occurrence of pseudo ring-bivalents in genetically induced asynapsis.
Canad. J. Bot. 1960 : **38** : 69–85.

Three hybrids, two of *H. jubatum* x *Secale cereale* and one of *H. jubatum* x *H. bulbosum*, were examined cytologically. The two genomes of *H. jubatum* showed autosyndesis in the *H. jubatum* x *S. cereale* hybrids and it was concluded that *H. jubatum* has two closely related genomes. Weak synapsis was observed in one of the *H. jubatum* x *S. cereale* hybrids. Strong asynapsis occurred in the *H. jubatum* x *H. bulbosum* hybrid, although pairing was complete in some cells at diacinesis. Several of these pairs, however, failed to remain together due to lack of chiasmata, while some remained together due to stickiness. The asynapsis of this hybrid is due to interaction of the genes of the *H. jubatum* x *H. bulbosum* genomes.

The chiasma distributions of the hybrids were tested for randomness by Gaul's formula [cf. XXV, 907]. It was found that the chiasma distributions of the *H. jubatum* x *S. cereale* hybrids followed a random pattern. In the *H. jubatum* x *H. bulbosum* hybrid, however, the distribution was disturbed by a secondary factor, the occurrence of pseudo-ring-bivalents. An explanation for the origin of these pseudo-bivalents is suggested. A reevaluation of Gaul's formula, in the light of the present study, is also presented.

432 GAUL, H. & MITTELSTENSCHEID, L.
Hinweise zur Herstellung von Mutationen durch ionisierende Strahlen in der Pflanzenzüchtung. (**Indications regarding the production of mutations by ionizing radiation in plant breeding**).
Z. Pflanzenz. 1960 : **43** : 404–22.

Reference is made to useful mutants reported in the literature and to some mutants of the spring barley 'Haisa' produced by the senior author; one of these is 3–4 days earlier and in tests over 2–3 years in three different places has yielded 6% more grain than the original Haisa; preliminary analyses suggest that the quality is also improved.

In connexion with the question of the relative merits of mutation breeding compared with more conventional methods, the opinion is expressed that the two methods should be regarded as complementary. Details are given of the techniques now available for irradiation, with indications of the purposes for which each is most suitable. Though the data are not yet sufficient for a final decision as to whether the maximum mutation frequency is lower with chronic than with acute irradiation, there are definite indications that it is so, and for this reason the Max-Planck-Institut at Cologne has installed a Co^{60} source for irradiation of plants during the flowering stage.

A report is given of an experiment in which barley grains were irradiated with three different doses of X rays, the results showing a marked correlation between the reduction in leaf length and the proportion of surviving plants; the frequency of chlorophyll mutations rose with the reduction in percentage of survivors and it is recommended that doses giving 10–20% survival should be given in breeding work, corresponding to a reduction of 25–40% in leaf length. This gives about twice as many mutations as doses with a survival rate of 50%, which have been more usual in the past. The percentage of mutations is lower in the side tillers and hence the plants should be sown thickly to reduce tillering. They must also be sown in isolation to prevent out pollination; the authors' own observations with barley have confirmed those of Caldecott *et al.* on oats [XXX, 324] concerning the increased tendency to cross fertilization in the progenies of irradiated seeds, particularly in partially sterile plants; the progeny of such plants in an irradiated six-rowed winter barley grown in proximity to a two-rowed barley contained 9·8% of intermediate ears resulting from out crossing, whereas the progeny of the fertile ears from the same population contained only 1·8%.

A study of the progeny of the fertile ears of the M_1 generation showed it to contain as high a percentage of mutants as that of the partially sterile ears and a lower percentage of sterility. Selection for fertility is therefore recommended as it does not reduce the percentage of point mutations but only removes the undesirable chromosome aberrations.

When the irradiation is repeated in a number of successive generations it is not practicable, with the high doses now recommended, to limit the material to the progeny of 1–2 grains, as has previously been done, and the use of half an ear or a whole ear, according to the crop, is recommended.

433 POLLHAMER, E.
Mutációs kísérletek tavaszi árpával III. Az MFB 104 tavaszi árpafajta mutánsainak variációs vizsgálata. (**Mutation experiments with spring barley. III. Studies on the variation of mutants of the spring barley variety MFB104**).
Növénytermelés 1960 : **9** : 27–38.

At the Martonvásár agricultural experimental station, Hungary, number of shoots per plant, ear weight, ear length, grain number per ear, plant height, number of ears per plant, 1000-grain weight, grain yield and fertility were studied in 41 X_4 mutants of MFB104. The mean of all the mutants was slightly lower than the parental mean for each of these characters, but mutant lines exceeding the parent were found for all characters except ear length and plant height. Differences among individual plants were generally greater in the mutants, but some mutants proved to be more homogeneous than the initial material with respect to numbers of shoots and ears per plant and number of grains per ear. The usefulness of variance analysis in the study of induced mutations is discussed and it is concluded that it is of value both in estimating the likelihood of obtaining desired mutants by a given mutagenic method, and in selecting the best mutants.

434 HENTRICH, W.
Versuche zur Anwendung von P^{32} in der Mutationszüchtung bei Sommergerste. I. Die Wirkung von P^{32} nach Einquellung von Samen in P^{32} Lösungen. II. Die Wirkung von P^{32} in verschiedenen Stadien der Ontogenese. (**Experiments on the use of P^{32} in mutation breeding in spring barley. I. The action of P^{32} after soaking seeds in P^{32} solutions. II. The action of P^{32} during different stages of ontogeny**).
Z. Pflanzenz. 1960 : **43** : 1–28, 113–46.

Grains of the spring barley 'Saale' were soaked for varying lengths of time in solutions of $NaH_2P^{32}O_4$ of varying concentrations, the beginning of the treatment being so arranged that all the treated grains and the controls were sown on the same date. In a further experiment the mildew-resistant line 4592_{51} was also treated. Measurements of the amount of P^{32} absorbed showed that it varied considerably from one grain to another, being greatest in the grains that germinated most rapidly; the percentage absorption diminished with increasing concentration of the solution, which is thought to be a consequence of a reduction in rate of development.

Treatment with higher concentrations of the order of 3 μC P^{32} per grain resulted in delayed germination, reduction in plant height and root development and various growth anomalies, together with delayed ear development, sterility and a variety of ear deformities; a high degree of lethality was observed with this dose but not with lower doses, except when the grains had not been previously soaked for 24 hr. in water, when lethality was observed with doses of 2 μC. A reduction in fertility of up to 6% was observed also in the following generation.

Cytological observations on the treated plants showed a certain amount of chromosome breakage at mitosis, though no inversions were seen. Meiotic irregularities were detected in 29% of the cells examined in Saale and in 74% in line 4592_{51}; both rings and chains were observed, indicating a high frequency of translocations.

In the second part descriptions are given of experiments in which the barley 'Saale' was treated with P^{32} at different stages of development; in the first series the plants were grown in liquid culture media without P until the one-two-leaf stage in 1957 and to the three-leaf stage in 1958; the solutions containing $KH_2P^{32}O_4$ were then applied. The resulting plants showed various growth anomalies and chlorophyll defects, though root development was normal; the ears were small, often deformed, ripened late and produced very few grains. The rate of survival diminished with increasing doses in the experiments of 1957 but not in 1958. Mitotic aberrations were not observed in root tips from plants treated with the lower doses; in those from higher doses chromosome breaks were observed in 1957 but not in 1958. All the meiotic figures seen were normal. Growing in water culture is not regarded as a good method for producing mutations. Other plants were grown in glass sand until the two-leaf stage, when they received KH_2PO_4; some plants received a certain amount of $KH^2P^{32}O_4$ at this stage, others received it at the beginning of earing and others at the time of flowering. Very few plants survived the application at the two-leaf stage, the doses of 0·25–0·75 μC per pot being almost lethal. The same dose applied at earing also proved too high, the survival being only 18%. The higher doses also had deleterious effects when applied at meiosis but only the highest of all caused a notable reduction in fertility and the size of grain was not affected; the progeny from these plants showed no morphological aberrations but were slightly reduced in fertility with the higher doses. Application of the radioactive isotope at anthesis produced no change in fertility or seed quality; the progeny however showed a certain reduction in fertility and a number of chromosome irregularities were detected. The doses applied at meiosis and anthesis are regarded as too low for the production of mutations, for which purpose the optimum dose would be from 4 to 6 μC P^{32} per pot. In 1958 the P^{32} was applied 3–4 days before meiosis and doses of 0·25–1·00 μC induced a reduction in fertility proportional to the dose, 1·00 μC causing a reduction of 75%. Application 8 days later had little or no effect on fertility but reduced the 1000 corn weight and germination capacity; the grains also contained larger amounts of radioactive phosphorus; thus the chances of producing mutations are considered to be greatest when the P^{32} is applied after meiosis, and since they will be caused principally during the early stages of embryo development the number of chimeras is expected to be smaller than in other treatments.

435 Heslot, H.
Ethyl methane sulfonate: a powerful mutagenic agent for cultivated plants.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 16.

Attention is drawn to the strong mutagenic effect of ethylmethane sulphonate, as indicated by the exceptionally high number of chlorophyll and morphological mutants induced in barley [cf. XXIX, 2627].

436 Zohary, D.
Studies on the origin of cultivated barley.
Bull. Res. Counc. Israel : Sect. D : 1960 : **9D** : 21–42.

Studies on spikelet characters associated with seed dispersal have been conducted on wild relatives of cultivated barley, as a means of assessing primitiveness or wildness of characters as against derived characters which could have evolved only under the impact of domestication. The *Hordeum* types studied included pure populations of *H. vulgare* and *H. spontaneum* as well as a wide range of intermediates and recombinants between these two species, which occur in Israel in hybrid swarms in many kinds of disturbed habitats. Some of the wild plants were similar to the Tibetan 6-rowed *agriocrithon* forms described by Åberg while others were brittle *intermedium* types. A progeny test involving 40 of these plants revealed that both types were of hybrid origin and this, together with other evidence, indicates that neither *H. agriocrithon* nor brittle *H. intermedium* forms can be regarded as genuine ancestral species.

The results indicated that the two-rowed condition in wild *Hordeum* species reflects an adaptive specialization in seed dispersal and that this specialization evolved geologically long ago, at the very start of the differentiation of this genus. At the beginning of agriculture, the section *Cerealia* of the genus *Hordeum* was in all probability represented only by distichous types. Establishment of six-row mutants has been possible only after domestication, after the wild mode of seed dispersal was drastically altered by man.

The origin of cultivated barley is explained on the basis of a "two-row" model and *H. spontaneum* is considered to be the sole ancestor of all cultivated barley forms. The mode of origin and the trends of modification in barley under domestication are discussed. As was originally suggested by De Candolle, western Asia is regarded as the place of origin of cultivated barley.

437 Rommel, M.
The occurrence of euploid and aneuploid hexaploid plants within the offspring of artificially induced tetraploid *Hordeum vulgare* L.
Canad. J. Genet. Cyt. 1960 : **2** : 199–200.

One individual with $2n = 42$ was discovered among C_1 seedlings derived from colchicine-treated ears of Edda x Anoidium. All plants derived from $2n = 28$ C_1 plants were subjected to root-tip counts in the two succeeding generations. C_3 Edda x Anoidium contained two plants with 40 and one with 41 chromosomes, while one individual with 40 and another with 41 appeared in C_3 Edda x Ricardo. Plants with $2n = 40–42$ died before heading. Probably they arose through fertilization of unreduced ♀ gametes with $n = 28$ by ♂ gametes with 14 or fewer chromosomes.

438 Enns, H. & Larter, E. N.
Note on the inheritance of *DS*; a gene governing meiotic chromosome behaviour in barley.
Canad. J. Pl. Sci. 1960 : **40** : 570–71.

A desynaptic mutant, which occurred in the progeny of partially sterile X-irradiated plants, has been studied. Cytological observations in the F_1 and F_2 derived from a cross between the mutant and normal barley suggest that the desynaptic character is governed by a single recessive gene, for which the symbol *ds* is proposed.

439 Manturova, I. M. & Veršinina, P. D.
(The biology of flowering and pollination of six-rowed barley in the Far North).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. **7** : 136–38. [Russian].

Strict self pollination was observed in four barley cultivars studied under subarctic conditions at the Jamal research station. Fertilization occurred while the flowering glumes were still tightly closed. It is concluded that hybrids can only be obtained by artificial crossing.

440 Lau, D.
Über die Beziehungen zwischen äusseren und inneren Qualitätsmerkmalen bei Braugerste im Hinblick auf die Braugerstenzüchtung. (**On the relations between external and internal quality characters in malting barley with reference to the breeding of malting barley**).
Kühn-Archiv. 1959 : **73** : 299–30.

Small-scale malting studies were carried out with many European barleys. It appeared that grain form, husk content and enzyme activity had a greater effect on the malting extract than 1000-grain weight and protein content.

24e N.I.B.E.M. (voormalig NaCoBrouw) Jaarboekje. [**24th Yearbook of the National Institute of Brewing Barley, Malt and Beer (formerly NaCo-Brouw)**]. 1960 : Pp. 104.

441 *Hendriksen, A. J. T. Brouwgerstveredeling in Nederland. (Breeding malting barley in the Netherlands). (pp. 28–35).*

Barley breeding in the Netherlands is still concerned largely with disease resistance rather than quality, but a malting-barley programme was initiated in 1956 by the NIBEM, in which four barleys of good malting quality have been crossed with four less good types. Progress is hampered by the lack of a rapid method for determining quality.

442 *Wilten, W. & Coenradie, J. Onderzoek van kwekersstammen zomergerst op brouwkwaliteit. (Tests of breeders' strains of spring barley for brewing quality). (pp. 36–43).*

The results of field trials and micromalting tests are given for new varieties tested in 1955–58 by the NIBEM. Several are superior in quality to the brewing barley Balder and in addition show promise in respect of yield and straw stiffness.

443 *Coenradie, J. Mout- en brouwproeven op praktijkschaal, oogst 1958. (Malting and brewing tests on a commercial scale, harvest 1958). (pp. 44–48).*

In full-scale trials of Balder, Ingrid and Proctor, the last-mentioned proved best.

444 *Wilten, W. & Coenradie, J. De veldproeven in 1959. (Field experiments in 1959). (pp. 49–62).*

MGH55026 and Gazelle (MGH55045) have given high yields in varietal trials and equalled Balder in malting quality. In tests of quality in lodged barley, Balder, Union and Ingrid showed a similar rise in protein content when lodged.

445 *Wilten, W. Opbrengsten, rassenstatistiek en raseigenschappen van zomergerst. (Yields, varietal statistics and varietal characteristics of spring barley). (pp. 63–66).*

Tabulated data on the yield, acreage and agricultural characters of the chief spring barleys grown in the Netherlands in 1959 are given.

446 Enčev, Ja.
(**Some questions of breeding malting barley**).
Naučn. Trud. selskostopan. Inst. Georgi Dimitrov. Agron. Fak. (Sci. Trans. G. Dimitrov Agric. Inst. Agron. Fac.). 1959 : **6** : 233–67. [Bulgarian].

An account of intervarietal hybridization started at Odessa and continued in Sofia is given. The customary progeny testing procedure was modified by introducing single plant selection of all material as a preliminary step to trials. The results include two early productive barleys of superior malting quality (Odessa 17 x Crimean 17) x Odessa 19 and Odessa 14 x Nutans 38/3. The former is now in the fourth generation and the latter in the second. In addition to these, mention is made of two high yielding hybrids of Caja obtained by the use of mixed pollen of Kuban' 30 + Spartan 34 and Kuban' 30 + Odessa 14 respectively.

447 Vettel, F. K.
Möglichkeiten der Vorausbestimmung von Malzeigenschaften und ihre Anwendung in der Braugerstenzüchtung. (**Possibilities of early estimation of malting properties and its application in breeding malting barley**).
Z. Pflanzenz. 1960 : **43** : 29–62.

The literature on the subject is reviewed from the standpoints of the factors that affect quality and methods of determining them on small quantities of grain. Small-scale malting methods should be supplemented by small-scale decoction methods to determine such qualities as stability of froth, cloudiness and yeast development in the beer. Estimations based on extract, as developed by Andersson and others [cf. XII, 20], are described fully, special attention being drawn to the high correlations that exist between barley and malt properties. It is calculated that these methods would make it possible to test 1800 breeding lines for extract or diastatic activity during the winter period from October to March, or 900 lines for both. Since certain varieties that are frequently used as parents sometimes give anomalous results in the tests, it would be advantageous to have them thoroughly studied in micromalting tests and this, it is suggested, could well be done by some central institution for the benefit of all breeders. Some correlations between quality and certain morphological features or germinating ability as reported in the literature are also mentioned. It is pointed out that, in spite of the value of the methods discussed, they have certain defects, one of these being that the diastatic activity determined is not completely correlated with the proteolytic and cytolytic activity. The results are affected by environmental and other factors and comparisons are only valid if a well-known standard variety is included. The methods are moreover still too complicated to be regarded as an ideal quick breeding method and simpler techniques are called for.

448 BENDELOW, V. M.
Prediction of barley malting quality. A comparison of a micro-malting method and barley analysis.
Proc. Amer. Soc. Brew. Chem. 1959 : 118–21.

Barley hybrids from a wide variety of parents were tested (1) by a micromalting technique, consisting in the analysis of green (unkilned) malt, (2) by barley analysis, which involves determinations of extract and saccharifying activity and (3) by a macromalting test; Montcalm was used as standard. Out of 135 hybrids, 21 did well in test (3), and of these, test (1) selected 19 and test (2) 16. Barley analysis also selected 19 which were not satisfactory in macromalting tests. This inefficiency of test (2) resulted from overestimation of saccharifying activity in crosses with parents involving Newal, Jet, Anoidium and Valentine. The micromalting procedure takes longer than barley analysis, however, and is regarded as a useful supplementary method rather than a routine technique.

449 GRILLOT, G.
La classification des orges cultivées (*Hordeum sativum* Jessen) et nouvelles variétés d'orge. [**The classification of cultivated barleys (*H. sativum* Jessen) and new barley varieties**].
Ann. Inst. nat. Rech. agron., Paris : Sér. B : 1959 : **9** : 445–552.

A discussion of the basic principles of barley classification and a description of previous attempts are included in this article. The author proposes a practical way of coordinating earlier systems by means of a new double entry classification based on the main ear and spikelet characteristics. The plan includes 228 divisions, 97 of which are filled by varieties previously described by other authors.

In order to test the ability of the system to take up further inclusions, a series of intervarietal and interspecific crosses were carried out in Rabat, Morocco. Among the progeny, 141 pure varieties and subvarieties were identified and it was found possible to include 87 of these in the proposed system of classification, which now has 104 unfilled gaps.

The names of all known varieties and subvarieties are listed, together with a tabulation of synonyms and of certain names no longer retained.

Among aberrations occurring in the progeny of certain crosses were forms with hairy pales, types with broad and hooded glumes and others with a hereditary aptitude to produce supernumerary grains. The author confirms the unity of *H. sativum* and emphasizes that the existence of homologous series of varieties within the same species may be explained by a relatively small number of mutations followed by hybridization and subsequent segregation.

450 SAWICKI, J.
Studia nad miejscowymi odmianami zbóż z rejonu Karpat. Cz. I. Jęczmień jary—*Hordeum vulgare* L. s.l. (**Studies on local varieties of barley from the Carpathian region. I. Spring barley —*H. vulgare* L. s.l.**).
Acta agrobot., Warszawa 1959 : **8** : 67–150.

Material collected from the Carpathian region and studied near Cracow during 1950–56 comprised the botanical varieties *nutans*, *erectum*, *nudum*, *coeleste* and *pallidum*. Among the characters observed in individual lines were a high degree of tillering, resistance to lodging, high 1000-grain weight, loss of awns at maturity and during harvesting and, in the two-rowed forms and the six-rowed naked barley, a high protein content; the last two characteristics are particularly desirable in fodder varieties. Some lines gave higher yields of grain and straw than the standard varieties with which they were compared. Unfavourable features included thick paleae, low volume weight in hulled forms and, in some lines, high susceptibility to fungal attack; others were however resistant and could be used for breeding. Studies of the variation and selective value of the different characters indicated that in two-rowed forms the best yield indicator was tillering and yield of the main spike expressed as a yield coefficient. Also of selective value were number of spikelets per spike, 1000-grain weight, ratio of grain to straw and length of the rachis internodes. In the variety *nutans*, a multiple correlation coefficient of $r = 0{\cdot}884$ ($P = 0{\cdot}01$) was obtained for tillering, number of spikelets per spike and 1000-grain weight with grain yield. Characters useful in selecting six-rowed barleys for grain yield include the yield coefficient and spike length.

451 MOËS, A.
La résistance au charbon nu (*Ustilago nuda*) de l'órge cultivée (*Hordeum sativum*). [**Resistance to loose smut (*U. nuda*) in cultivated barley (*H. sativum*)**].
Rev. Agric., Brux. 1960 : **13** : 120–24.

Dieudonné and Vanderwalle succeeded in artificially inoculating 163 winter barleys and 1003 spring barleys with *U. nuda* between 1941–1946 and the present study is an extension of their work. An improved inoculation system, based on the removal of the tip of the glumes and the insertion of the flower in a cloud of dry spores, was used. The trial included 118 winter varieties and 1030 spring varieties; 15 of the former and 618 of the latter had shown resistance to infection in the earlier trial.

Immunity to the biotypes of loose smut existing in Belgium was established in 6 winter and 13 spring varieties. Details are given of their morphological appearance and origin. Although the work of annual artificial inoculation is continuing, it appears that these varieties constitute an interesting source of genetic resistance to loose smut, and some are now being integrated into the hybridization programme at the Gembloux Experimental Station.

452 COTTINGHAM, C.
Inheritance of resistance to covered smut in several hybrids of barley.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–536 : p. 3483. (Abst.).

From crosses involving Pannier, Odessa, Chevron and Jet, it was found that resistance to *Ustilago hordei* race 6 was governed by two gene pairs. One gene pair was found to govern also the characters covered *v.* naked caryopses and black *v.* blue aleurone in the cross Pannier x Jet.

453 SCHEIN, R. D.
Physiologic and pathogenic specialization of *Rhynchosporium secalis.*
Bull. agric. Exp. Sta. Penn. 1960 : No. 664 : Pp. 29.

A detailed report is provided of (1) the identification of races of *Rh. secalis* occurring in the USA, (2) screening nearly 1000 winter barleys for reaction to different races and (3) cultural variability of the pathogen [cf. XXX, 1341]. No variation was found in nucleus number (one per cell).

454 SCHEIN, R. D.
Winter-hardy, scald-resistant barley selected from world collection.
Sci. Fmr., Pa. 1960 : **8** : No. 1 : p. 3.

Of 991 barleys from a world collection tested in Pennsylvania, 231 were classified as winter hardy. Lines resistant to different races of *Rhynchosporium secalis* were also found [cf. XXX, 1341].

455 MIYAMOTO, Y.
(**Studies on cereal wilts. IV. On barley yellow mosaic virus. 2**).
Nihon Shokubutsubyori Gakkai Ho/ Ann. phytopath. Soc. Japan 1958 : **23** : 199–206. [Japanese].

The relative susceptibilities of a large number of Japanese barleys to the above soil-borne disease are recorded. Naked varieties were, in general, more resistant than hulled varieties and six-rowed varieties more than two-rowed. Among wild species, *Hordeum spontaneum* var. *eu-spontaneum*, *H. murinum*, *H. gussoneanum* and *H. pusillum* were resistant. Out of a set of linkage testers (I–VII), resistance was only found in testers I and VI.

456 RASMUSSON, D. C. & SCHALLER, C. W.
The inheritance of resistance in barley to the yellow-dwarf virus.
Agron. J. 1959 : **51** : 661–64.

It is concluded that a single incompletely dominant gene confers resistance in each of the varieties CI1227, CI1237, CI2376 and Abate. Four of the six possible crosses were investigated, and the varieties were found to derive their resistance from the same gene, here designated Yd_2. No linkage was found between this gene and genes conditioning row number, awn length, lemma and pericarp colour, and earliness.

MILLETS AND SORGHUMS

457 STEUCKARDT, R.
Untersuchungen über die Wirkung von Röntgenstrahlen auf Rispenhirse (*Panicum miliaceum* L.) nach einmaliger und mehrfacher Bestrahlung. I. Die Mutabilität nach einmaliger Bestrahlung sowie die Beziehungen zwischen Auslesebeginn und Selektionserfolg. II. Die Chlorophyllmutationsrate und das Mutationsspektrum nach mehrfach wiederholter Bestrahlung. [**Investigations on the action of X rays on millet (*P. miliaceum* L.) after single and multiple irradiation. I. The mutability after a single irradiation and the relationships between the time of starting selection and its effectiveness. II. The chlorophyll mutation rate and the mutation spectrum after multiple repeated irradiation**].
Z. Pflanzenz. 1960 : **43** : 85–105, 297–322.

A relatively homogeneous line referred to as Stamm 36 [Strain 36] was irradiated with doses of X rays varying from 12 to 30 kr. Very little retardation in germination was observed even with the highest doses, but many seedlings failed to develop and others showed various growth anomalies; there was a reduction in height and fertility, roughly proportional to the dosage; fertility was 65% in plants from 60 kr. when grown in the greenhouse, but in the open the survival rate and fertility were further reduced and for practical purposes the optimum dose is considered to be 18–21 kr.

Observations on the progenies of 3093 X_1 plants in 1957 led to the selection of 303 progenies as being possible mutants. Their progenies were studied together with the progenies of over 3000 unselected X_2 plants. Only 25% of the families selected in the X_2 proved to be mutated and a greater range of mutants was obtained from the X_3 of the unselected X_2 panicles; 95% of these were confirmed as mutations in the X_4 generation. Altogether 188 mutant types were discovered, some of which are described. The majority of the mutants proved to be changed in more than one character, often in 2–3 and occasionally 4–5. The mutants described include various chlorophyll aberrations, 32 forms with short straw, 2 with long straw, others with procumbent stems, pubescent stems and leaves or pendent panicles. In some mutants the panicles were more compact but in most they were less compact than in the parent form. Various changes in grain colour and size were noted, one mutant having a 1000-kernel weight of 5·8 g. and another 6·3 g.; the former was also earlier in maturity. Several mutants ripened 3–14 days earlier, earliness being usually combined with short straw; a certain number of mutants were later than the parent. Various degrees of sterility were observed in some of the mutants.

Repeated irradiation and increased dosage raised the mutation rate but the frequency of mutation was not proportional to the dose. The mutation spectrum widened with increased dosage and with repeated irradiation; the frequency of individual mutant types seemed to be independent of the dose. Mutants found only rarely after one treatment were more frequent after multiple irradiation. The *striata* forms frequent in X_2 plants were found to be chimeras, the mutations involved being identified in the X_3 generation. Fifty-eight progenies with more than one mutant type were found.

458 ROMINGER, J. M.
Taxonomy of *Setaria* (Gramineae) in North America.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–4561 : p. 1558. (Abst.).

A digest is given of a monograph which gives (1) a review of the literature published during the past four decades on the taxonomy, cytology, geographical distribution, economics and other aspects of *Setaria* and (2) a revision of North American representatives of the genus, together with suggestions as to phylogenetic relationships.

459 **New bajras.**
Indian Fmg. 1960 : **10** : No. **2** : p. **14.**

Earliness and easy threshability are the advantages of the short-duration hybrid X3 of *Pennisetum typhoides*, released in Madras State. It is particularly well suited to the Coimbatore and Salem districts, where it has outyielded the local type by 25%. In the Punjab, selection S530 has outyielded recommended and local varieties under both rainfed and irrigated conditions.

460 RAMAN, V. S. & KRISHNASWAMI, D.
Studies on the progeny of quadruple monosomic *Pennisetum purpureum* Schum.
J. Madras Univ. 1959 : **29** : 183–86.

One plant with $2n = 45$ and another with $2n = 38$ were obtained from open pollination of two individuals with $2n = 24$, which were derived from *P. purpureum* ($2n = 28$) pollinated by the amphidiploid ($2n = 42$) of *P. typhoides* x *P. purpureum* [cf. XXIV, 2978]. The mean configuration at meiosis in the $2n = 45$ plants was

$3{\cdot}6_{IV} + 13{\cdot}6_{III} + 1{\cdot}3_{II} + 2{\cdot}6_{I}$ and in the $2n = 38$ plant $6{\cdot}2_{III} + 10{\cdot}2_{II} + 3{\cdot}8_{I}$. It is concluded that these two individuals had normal *P. purpureum* and the amphidiploid as ♂ parent, respectively. Chromosome formulae are suggested for the two plants. A 24-chromosome individual resulting from pollination of one of the $2n = 24$ mother plants by *P. typhoides* probably arose through apomixis.

461 VENKATARAMAN REDDY, T.
Recent advances in sorghum improvement.
J. Madras Univ. 1959 : **29** : 69–78.

In this review, particular attention is paid to the recent developments in the production of commercial hybrids by the utilization of cytoplasmic male sterility. It is pointed out that American sorghum hybrids do not conform to Indian requirements; certain of their morphological characteristics are undesirable, and they do not seem to be adaptable to Indian climatic conditions. However, certain hybrids resulting from crosses between American male-sterile types and Indian varieties have shown considerable promise.

The breeding of varieties resistant to *Striga* has not proved very successful and it is suggested that a cotton-sorghum rotation may deal with this problem more effectively. The importance of yellow endosperm in sorghum is pointed out and the incorporation of this character into Indian varieties is recommended.

462 SAURAT, A.
Amélioration des cultures vivrières au nord-Cameroun. La sélection des sorghos. (**The improvement of food crops in the nothern Cameroons. The selection of sorghums**).
Riz et Rizic. 1960 : **6** : 94–101.

Using a method of field selection described in this article, sorghum yields may be improved by as much as 30% over a 3-year period. In order to improve other agronomic characteristics, the introduction of new varieties is required; thus the recent introduction of the very early variety Damougari has allowed the incorporation of *Dolichos lablab* as a catch crop into the rotation.

463 CASADY, A. J., HEYNE, E. G. & WEIBEL, D. E.
Inheritance of female sterility in sorghum.
J. Hered. 1960 : **51** : 35–38.

Data from F_1, BC_1 and test-cross progenies resulting from Early Kalo 231 x Westland crosses and Early Kalo 231 x Pink Kafir crosses showed that the complementary effect of two dominant genes, Fs_1 and Fs_2, results in female sterility when in the double heterozygous condition. When three dominant genes are present, $Fs_1Fs_1Fs_2fs_2$ or $Fs_1fs_1Fs_2Fs_2$, dwarf plants that do not produce heads occur. It is assumed that the double homozygous dominant condition, $Fs_1Fs_1Fs_2Fs_2$, would also result in dwarf, headless plants, if it were possible to recover this genotype. Two crosses of Early Kalo 231 x Western Blackhull were also made, and one failed to support this hypothesis. The suggestion is made that genetic complications affecting female sterility may be present in Western Blackhull.

The evidence indicates that Early Kalo 231 may carry one of the complementary genes (Fs_1) and that Westland, Pink Kafir and Western Blackhull may carry the other (Fs_2). However, these four varieties are heterogeneous in respect of these two genes. Neither the Fs_1 nor the Fs_2 gene has any apparent effect when occurring alone.

464 BOSHI SEN & SACHCHIDA NANDA SRIVASTAVA
Hybrid jowar (milo).
Sci. & Cult. 1960 : **25** : 701–02.

F_1 hybrids of Combine Kafir 60 (♂ sterile) with different varieties have given higher yields than their respective parents in a trial at the Vivekananda Laboratory, Almora, UP. The hybrids with Hegari and DD38 outyielded these parental varieties by as much as 176·8% and 99·1% respectively.

465 WATKINS, P. W., HITTLE, C. N., McKIBBEN, G. E. & BROWNING, D. R.
Grain and forage sorghums.
Bull. Ill. agric. Exp. Sta. 1959 : No. 659 : Pp. 24.

The results of tests of varieties and hybrids in several localities in Illinois are given.

466 CYPERT, C. E., WILLIAMS, D. H., JONES, H. D. & NIELSON, A. K.
Performance of sorghum hybrids and varieties in New Mexico, 1959.
Res. Rep. N. Mex. agric. Exp. Sta. 1960 : No. 40 : Pp. 24.

Trials of varieties and hybrids, chiefly of grain sorghum, at four substations in New Mexico are reported.

467 FOSTER, A. E.
Genetic analysis of colchicine-induced diploid mutants in Sorghum.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–848 : p. 3477. (Abst.).

A true-breeding mutant, P15, derived from colchicine-treated Experimental 3, was crossed with its full sib P6, and from a study of the F_2 and F_3 progenies the following estimates were obtained of the number of genes affecting the expression of six mutant characters: heading date, 5 or 6 genes; plant height, 3; leaf width, at least 1; number of tillers, at least 1; seedling base colour, 1; and awn development, 1.

To compare the colchicine-induced mutation to strong awns with an irradiation-induced mutation of the same character, P15 was crossed with an awned segregate from irradiated Experimental 3. The F_1 plants were all strong-awned and their progeny did not exhibit transgressive segregation. P15 was also crossed with 39–30–S, a strong-awned ancestor of Experimental 3, and again the F_1 plants were all strong awned and no transgressive segregation occurred. It is concluded that the gene for awn development may be the same in the three lines. The mutations discussed here (at least 12 and probably more) are considered to be point mutations.

468 D'CRUZ, R. & DESHMUKH, J. N.
Behaviour of B chromosomes in *Sorghum purpureo-sericeum*.
Poona agric. Coll. Mag. 1960 : **51** : 30–34.

The supernumerary B chromosomes in *S. purpureo-sericeum* did not pair with A chromosomes during meiosis but either were present as univalents or formed bivalents and multivalents among themselves. A regular anaphase separation was observed during meiosis, suggesting that the B chromosomes have a well-defined spindle attachment region. Precocious division of unpaired B chromosomes was also noted, an occurrence not previously reported in *Sorghum*.

The supernumeraries continued to behave irregularly during three successive generations.

469 RAMAN, V. S. & KRISHNASWAMI, D.
Accessory chromosomes in *Sorghum nitidum* Pers.
J. Indian bot. Soc. 1960 : **39** : 278–80.

Meiosis was studied in a clump of *S. nitidum* with $2n = 10 + 2$ B chromosomes. The accessories are of standard (M) type and pair regularly with each other. As in *S. purpureo-sericeum* [cf. XI, 271], they are eliminated from root-tip cells.

470 CARLSON, G. E. & ATKINS, R. E.
Effect of freezing temperatures on seed viability and seedling vigor of grain sorghum.
Agron. J. 1960 : **52** : 329–33.

The effect of freezing temperatures on grains varying in moisture content was investigated in Norghum, Combine Kafir 60 and two hybrids. The primary effect was reduction in viability, with no appreciable reduction in seedling vigour. Genotype was among the factors influencing amount of reduction in viability. Determinations of viability from grain soaked to specific moisture contents may not give the same evaluation of varieties and hybrids with respect to tolerance of freezing temperatures as tests in which maturing seeds are used.

RICE

471 DUARTE, A. J. S.
Ensaios com microtalhões. (**Trials with microplots**).
Agron. lusit. 1959 : **21** : 75–90.

A suitable technique for analysis of rice variety trials involving small plots liable to damage by rodents or birds is described. The results of a trial of established varieties and new strains at the Estação Agronómica Nacional, using this method, are reported.

472 ANGLADETTE, A.
Notes sur la riziculture à Ceylan. (**Notes on rice cultivation in Ceylon**).
Riz et Rizic. 1960 : **6** : 65–93.

This article includes a brief account of current plans and methods adopted for rice improvement. It is stated that *japonica* x *indica* crosses have failed to give encouraging results in Ceylon. The origin and certain agronomic characteristics of 14 varieties recommended for irrigated areas are listed, together with the names of three introduced varieties showing promise for upland cultivation.

473 ARNOUX, L.
Méthodes d'amélioration du riz et de multiplication des semences en Afrique Tropicale d'expression française. (**Methods for rice improvement and seed multiplication in French Tropical Africa**).
Riz et Rizic. 1960 : **6** : 102–26.

A detailed account is given of the objectives, organization and techniques used for rice improvement in French continental Africa and Madagascar.

474 **Abstract bibliography of rice. 1941-50.**
College, Laguna, Philippines 1959 : Pp. 314. (Mimeographed).

This bibliography contains 1283 entries grouped under 27 subject headings, including Breeding and selection, Cultural practices, Diseases and their control, Genetics and cytology, Insect and animal pests, and Varieties and varietal tests.

475 MATSUO, T., NAKAZIMA, T., KOMATSUZAKI, A. & SUGAWARA, K.
(A comparison between pedigree breeding, mass selection and bulk breeding in rice).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 33–41. [Japanese].

A hybrid population from the cross Norin 36 [Ministry of Agriculture and Forestry 36] x Li-chih-chiang was bred (1) by the pedigree method, (2) by mass selection, the grain being mixed in lots, and (3) by bulk breeding at three different locations. In each case, the progenies were taken to the F_6 and testing was performed in the F_7 and F_8.

The pedigree method proved superior to the bulk method in respect of selection for yield, straw strength and earliness. Parent-offspring correlations in the pedigree method were high for heading time, length of straw, length of panicle, grain quality and blast susceptibility and low for grain weight and panicle number. The effects of natural selection at the three locations at which bulk breeding was conducted differed.

476 MIZUSHIMA, U. & KONDO, A.
(Fundamental studies on breeding rice by hybridization between Japanese and foreign rices. II. A structural difference between the investigated Japanese and Indian varieties inferred from the anomalous segregation of anthocyanin pigmentation).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 1–9. [Japanese].

The F_3 plants with colourless apiculi from the cross Norin 1 ($C^{B}Sp^{d}$) x Surjamkhi ($C^{B}Sp$) already described [XXX, 2703] were crossed with testers of genotypes $C^{Br}Sp$, $C^{B}Sp^{+}$ and $C^{Bp}Sp^{+}$ and segregation was observed in the resultant F_2 progenies. It appears that some of the colourless initial F_3 plants carried *C* derived from Norin 1, some from Surjamkhi and some duplicate *C* loci from both. It is therefore concluded that the Japanese and Indian varieties used have a structural chromosome difference involving the *C* locus. Some doubtful evidence of duplication of the *Sp* locus in one of the F_3 initial plants was also obtained. There appears to be no direct connexion between partial sterility and deficiency or duplication of *C* and *Sp*.

477 TAKAHASHI, N.
Studies on the internal factors of rice seed regulating the germination velocity.
Rep. Inst. agric. Res. Tôhoku Univ. : Ser. D. 1960 : **11** : 1–7.

Data on the germination behaviour of Ou 195 and Ou 200 (respectively fast and slow germinating at low temperature) and on the F_1 and F_2 of crosses between these varieties were analysed by the method of least squares. The difference between the two varieties in rapidity of germination at 20° C. during after-ripening, was attributable to a genotypical difference in both the seedcoat and embryo, while after this stage the genotypical difference in only the seedcoat was decisive.

478 RICHHARIA, R. H. & TIWARY, N. P.
Inheritance of coleoptile colour in paddy (*Oryza sativa* L.).
Proc. Bihar Acad. agric. Sci. 1957–1958 : **6 & 7** : 22–40.

From a study of the seedlings from different tillers of 46 plants representing three segregating cultivars, no conclusion could be reached concerning mode of inheritance of coleoptile colour. Tiller behaviour was not necessarily uniform; in a number of cases some tillers of a given plant bred true while others segregated. Whether purple coloration behaved as a dominant or recessive depended on the parental culture, while the number of genes apparently involved in coleoptile colour also varied according to the parental culture, as well as depending on whether counts were based on the seedlings from segregating tillers only or on those derived from both segregating and pure-breeding tillers.

479 KADAM, B. S. & D'CRUZ, R.
Inheritance of zebra chlorophyll deficiency in rice.
Sci. & Cult. 1960 : **25** : 532–33.

A "zebra" seedling mutation found in the variety Kolamba at the Rice Breeding Station, Bombay Province, and another in Mahadi each depended upon a single recessive gene, respectively designated *zk* and *zm*.

480 Sakai, K.-I.
Practical purity and the method of maintenance of established varieties of rice.
News Lett. FAO Internat. Rice Comm. 1959 : **8** : No. 4 : 7–14.

From an analysis of genetic variability in hybrid and pure-line varieties cultivated in Ceylon it is concluded that established varieties are not necessarily genetically homogeneous for quantitative characters of economic importance. A multiplication scheme is described by means of which "practical purity", i.e. heterogeneity in polygenic characters without deterioration in homogeneity of visible characters, is maintained. Discarding inferior lines for quantitative characters is considered to be more effective than secondary selection of a small number of superior lines.

481 Richharia, R. H., Misro, B., Butany, W. T. & Seetharaman, R.
Linkage studies in rice (*Oryza sativa*, L.).
Euphytica, Wageningen 1960 : **9** : 122–26.

This brief review includes crossing-over data for 32 characters studied at the Central Rice Research Institute, Cuttack, India.

482 D'Cruz, R.
A linkage between two basic genes for anthocyanin colour in rice.
Sci. & Cult. 1960 : **25** : 534–36.

Ghose [cf. XXVIII, 3921] referred to the cross Fukoku x Marichbeti, in which the characters of stigma and glume colour each depended on four different pairs of genes. From the segregation ratio of 162 pigmented : 94 unpigmented it may be assumed that one pair was basic and complementary to any two of the three pairs of complementary and duplicate genes. Analysing the data given by Ghose, the author finds that the basic genes controlling stigma and glume colour are linked, with a value of 2·02% in the coupling phase.

483 Parthasarathy, N.
Final report on the international rice hybridization project.
News Lett. FAO Internat. Rice Comm. 1960 : **9** : 12–23.

Results of the *indica* x *japonica* hybridization project are reported [cf. XXV, 1103]. The initial crosses were carried out at the Central Rice Research Institute, Cuttack, India; the F_1 hybrids showed considerable heterosis with regard to plant height and number of ears per plant but their grain yields were generally inferior to the *indica* parents. The spikelet sterility averaged 60% in the F_1, the pollen sterility being slightly lower. Cytogenetical investigations indicated that chromosome pairing during meiosis was regular although at anaphase there were irregularities such as occasional laggards and chromosome bridges. These could not however completely account for the high degree of sterility in the F_1 hybrids. There was some evidence of the influence of the cytoplasm on sterility in certain crosses. *Indica* varieties originating from Ceylon and Pakistan gave a significantly lower mean sterility than those originating from other countries.

As a possible means of overcoming this problem, the highly-sterile F_1 hybrids were back crossed to the *indica* parents. The BC_2 seed material was then sent to the participating countries but so far only Vietnam and India have reported any success with this material.

In many cases the high sterility of F_1 hybrids did not finally prove to be a handicap as there was enough scope for selection of plants with high fertility in the succeeding generations; in these instances fully fertile progenies were obtained in the later generations in the participating countries. The study of segregation of sterility in F_2s and F_3s indicated that inter-racial sterility was mainly governed by genes and the steady improvement of fertility in later generations could be explained on the bases of elimination of infertile combinations. Environment also affects the expression of this character; thus in Indonesia, the sterility of the hybrids was more marked in north Sumatra than in Java.

Further details are given of the progress achieved in the participating countries. In most countries lines homozygous for characters such as height, grain size and flowering time were obtained in the F_6, although in some cases considerable heterozygosity for the above factors was found even in F_7 and F_8 generations.

484 Chandraratna, M. F. & Sakai, K.-I.
A biometrical analysis of matroclinous inheritance of grain weight in rice.
Heredity 1960 : **14** : 365–73.

Grain weight in reciprocal crosses between the pure-line varieties Vellai Ilankalayan 28061 and Panduruwi, analysed in Ceylon, showed a maternal effect. A genetic model was constructed on the assumption that a system of extranuclear determinants may (1) interact with the genotype, (2) be transmitted to the progeny through the maternal cytoplasm and (3) influence phenotypic expression in the progeny for one generation. Comparison of experimental results with expected values demonstrated the adequacy of the model. Formulae relating to grain weight in successive generations were worked out and components of variation were partitioned according to the methods of Mather. The values for m (coefficient of maternal effect), heritability in the broad sense and heritability in the narrow sense were respectively 32%, 0·77 and 0·40. Assuming that all the genes had equal additive effects and one parent carried all the plus alleles and the other all the minus ones, the number of effective factors was calculated to be about 10.

485 SVINAREV, V. I.
(The processes of form development in rice fields on flood plains and in the Volga delta).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **132** : 1183–86. [Russian].

Many wild rice forms were observed mixed with cultivars grown in the Astrahan' province. The wild forms were highly variable and continued to give rise to new forms, some of which resembled cultivars and others wild *Oryza* species. Data are given on variability of pure lines, selected from the wild types in respect of tillering, plant height, panicle length, grain number per panicle, grain yield per plant, 1000-grain weight and husk content. Many cultivars bore panicles with some grains of wild type, including coloured grains.

486 DASANANDA, S.
Method of reducing the number of varieties in Thailand.
News Lett. FAO Internat. Rice Comm. 1960 : **9** : 7–11.

By means of selection, variety tests and regional trials, rice varieties suitable for incorporation into future hybridization programmes were chosen in Thailand.

487 DAWSON, E. H., BATCHER, O. M. & LITTLE, R. R.
Cooking quality of rice.
Rice J. 1960 : **63** : No. 5 : 16, 18–19, 22.

A survey is given of investigations carried out since 1954 by the Food Quality Laboratory of the Human Nutrition Research Division, US Agricultural Research Service, to develop tests for measuring varietal differences in cooking quality by subjective, physical and chemical means. Information is provided on the value of different types of test, the physical and chemical nature of disparities in cooking behaviour and suggested lines of future research.

488 LITTLE, R. R. & HILDER, G. B.
Differential reaction of milled white rice varieties to a Millon reagent containing trichloroacetic acid and mercuric acetate.
Cereal Chem. 1960 : **37** : 475–82.

When samples of rice flour representing 25 varieties were treated with a Millon reagent containing 18·75% trichloroacetic acid and 0·5 g. mercuric acetate, followed by dehydration in solvents, it was found that the varieties fell into three groups with respect to coagulation behaviour of the sediment and two with respect to alteration of the starch granules. Both reactions differed in degree among the varieties within the groups and were in most cases related to grain length, palatability characteristics and other quality factors. Coagulation behaviour may prove useful in testing varieties for suitability for some food-processing operations.

489 OTA, K., YASUE, T. & NAKAGAWA, M.
(Studies on salt injury to agricultural crops. XIII. Intervarietal differences in the resistance to injury of irrigated and upland rice as shown by period of germination and the seedlings).
Gifu Daigaku Nogakubu Kenkyu Hokoku/Res. Bull. Fac. Agric. Gifu Univ. 1958 : No. 9 : 7–11. [Japanese].

The grains of 58 Japanese and introduced varieties were germinated in Petri dishes containing a graded series of NaCl solutions. The relative growth of the varieties is recorded, those least injured by NaCl being Java 1, Ayanishiki [Brocade] and Shuho. [Cf. XXIX, 2497].

490 GHOSH, B. N.
A note on the resistance of boro paddy to stem borer infestation.
Sci. & Cult. 1960 : **25** : 547–48.

Number of larvae of *Schoenobius incertellus* per plant ranged from 0·3 in Jhangi I to 35·2 in the scented variety Habigunj boro–II, among the eight varieties of spring rice tested at the Rice Research Station, Chinsurah, W. Bengal. Resistance was positively and significantly correlated with water content of the stem and leaf.

491 Nuove razze di riso. **(New varieties of rice).**
Progr. agric., Bologna 1960 : **6** : 342–43.

Baraggia, from Agostano x (P6 x Blue Rose), is described as awnless, early, highly resistant to lodging and good in yield; its grain is of the ordinary class.

Colosso [Colossus], from Rigido Rossi x G. Rossi, is almost awnless, resistant to lodging and shedding and high yielding; its grain is classed as fine.

492 Silva, M. V. e, & Mendes, F. P.
'Lusitano' uma nova forma cultivada de arroz. (**Lusitano, a new cultivated form of rice).**
Agron. lusit. 1959 : **21** : 5–17.

The above variety, selected from Allorio x Arroz da Terra [Local rice], is an early rice with white caryopses and adapted to Portuguese growing conditions.

493 Singh, G., Sohan Singh Saini & Singh, J.
T23—a fine quality rice for Punjab hills.
Indian Fmg. 1960 : **10** : No. **3** : p. 19.

Type 23 is expected to meet the need for an early-ripening, fine variety suited to the Punjab hills, where hitherto only coarse rice has been grown. In cooking quality, T23 nearly equals Basmati 370, the fine variety cultivated in the plains.

494 Fernando, L. H.
The progressive reduction in the number of rice varieties under issue in Ceylon.
Trop. Agriculturist 1959 : **115** : 183–86.

The number of recommendations has now been reduced to 14 varieties, which are listed.

495 Singh, G. & Sohan Singh Saini
Wipe out wild rice from your rice fields.
Indian Fmg. 1960 : **10** : No. **3** : 6–7.

Three purple-leaved varieties have been developed for the Kangra hills, Punjab, by hybridization. The colour of their foliage facilitates roguing of the green plants of wild rice. They mature as early and yield as well as the improved green-leaved varieties developed for this region.

496 Morinaga, T.
Note on genom analysis in *Oryza* species.
News Lett. FAO Internat. Rice Comm. 1959 : **8** : No. **3** : 10–11.

Information is given on (1) the number and association of chromosomes at metaphase I in PMCs of 18 F_1 interspecific hybrids and their parents, and (2) the genome constitution postulated for each species on the basis of (1). The following genome formulae are given: *O. sativa, O. cubensis, O. glaberrima, O. breviligulata*, AA; *O. officinalis*, CC; *O. paraguaiensis, O. latifolia*, CCDD; *O. minuta, O. eichingeri*, BBCC.

497 Chang, W.-T.
(**Genic analysis by the reciprocal translocation method).**
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 49–51. [Japanese].

Lines homozygous for reciprocal translocations resulting from X irradiation of Pei-ku [White Husk] and Kisshin [cf. XXVI, 1327] were crossed with glutinous rices varying in apiculus pigmentation. Linkages between some of the translocations and *gl* (glutinous) and genes controlling heading date and plant height were detected. Linkage involving translocations and pigmentation genes (*C* and *Sp*) was not found.

498 Langfield, E. C. B. & Basinski, J. J.
The effect of time of planting on behaviour of rice varieties in northern Australia.
Trop. Agriculture, Trin. 1960 : **37** : 283–92.

Extensive intervarietal differences in such characteristics as plant height, number of tillers, time to earing and percentage of sterile spikelets were observed when 17 rice varieties were planted at 14-day intervals over a one-year period at the Kimberley Research Station in northern Australia. The significance and practical implications of these results are discussed.

499 Bernardes, B. C. & Bernardes, I. A. C.
Estudo de épocas de plantações de novas variedades criadas na E.E. de Arroz. (**Study of planting dates of new varieties bred at the Rice Experimental Station).**
Lav. Arroz. 1958 : **12** : 393–95.

Data are provided on the yields given by seven new Brazilian varieties when planted at fortnightly intervals over the period 15 September to 15 December. Optimum planting date was different for the various varieties, and for different planting dates different varieties were best. The differences were significant.

500 Marie, R. & Denoy, I.
La rizière expérimentale du Merle en 1958. (**The experimental rice field at Le Merle in 1958).**
Progr. agric. vitic. 1959 : **76** : 93–99.

Preliminary observations were made by the

Montpellier Plant Improvement Station on growth cycle, height, grain type and resistance to lodging and shattering in rice varieties introduced from central Africa, Argentina, China, Egypt and Hungary. Many of the varieties matured very late; the earliest will undergo further testing.

501 Marie, R. & Denoy, I.
La rizière expérimentale du Merle en 1958. **(The experimental rice field at Le Merle in 1958).**
Progr. agric. vitic. 1959 : **76** : 181–86.

This further report on trials of introduced rice varieties [cf. 500] deals with material from Iran, Italy, Japan and Madagascar. Most varieties matured very late and some were unable to complete their development; the best are being retained for further observation.

Of seven cold-resistant Japanese varieties tested, Shin Ei, Fujisaka 5 and Norin 17 [Ministry of Agriculture and Forestry 17] were the most productive.

502 Marie, R. & Denoy, I.
La rizière expérimentale du Merle en 1958. **(The experimental rice field at Le Merle in 1958).**
Progr. agric. vitic. 1959 : **76** : 231–37.

The performance in France of rice varieties introduced from Morocco, Portugal, Russia, Belgian Congo, Ivory Coast, Senegal, Sudan and Chad is reported. An early hybrid 58–1 developed from Sesia x Allorio 46 is high yielding and resistant to lodging and shattering. Hybrid 58–11 from Stirpe 136 [Strain 136] x Senatore Novelli 19 is very resistant to shattering. Plants of Allorio 11, Precoce Corbetta [Corbetta Early] and Maratelli treated with γ rays from a Co^{60} source have yielded a few short-strawed mutants [cf. 501].

503 Van, T. K.
Secondary selection in pure lines of rice.
Nature, Lond. 1960 : **187** : 169–70.

Reselection in the pure-line varieties Siam 29, Nachins and Seraup Kechils in Malaya has resulted in significant increases in yield over the corresponding parental varieties, without alteration in morphological characters. Reselection of a fourth variety, Mayang Sabatils, gave only a nonsignificant increase. These results are interpreted as indicating that established improved varieties are either not completely homozygous or that mutations affecting yield accumulate.

504 Yamada, N.
A note on the analysis of the yield potential in the *indica* hybrid, H-4.
News Lett. FAO Internat. Rice Comm. 1959 : **8** : No. 4 : 20–23; also Trop. Agriculturist 1959 : **115** : 173–78.

An analysis of the yield potential of H–4 (Murungakayan 302 x Mas) under normal field conditions is reported [cf. 505].

505 Yamada, N.
The nature of fertilizer response in *japonica* and *indica* rice varieties.
News Lett. FAO Internat. Rice Comm. 1959 : **8** : No. 4 : 14–19; also Trop. Agriculturist 1959 : **15** : 163–72.

Yield components and dry-matter production were studied at three levels of fertilizer application in potted plants of the *japonica* varieties Norin 1 [Ministry of Agriculture and Forestry 1], Kanan 8 and Taichung 65 and *indica* varieties Murungakayan 302 and H–4 at Peradeniya, Ceylon. All varieties except Murungakayan 302 showed a high yield response to fertilizer. Increase in yield in Norin 1 and H–4 was entirely due to increased number of panicles per hill, but in Kanan 8 was primarily due to increase in weight per panicle. Taichung 65 behaved as an intermediate type. *Indica* varieties such as Murungakayan 302, because of their very high rate of total dry matter production per day, are capable of producing more dry matter than *japonica* varieties, but the dry-matter distribution to the grain is less efficient, with a low ratio of grain : total dry matter and high degree of sterility. Murungakayan 302 is suitable for broadcasting on unfertilized soils or at moderate levels of fertility; with high application of fertilizer sterility increased in this variety. H–4, on the other hand, is able to produce very high yields when transplanted with wide spacing and at high levels of fertilizer. Tillering capacity and panicle number assume importance in breeding varieties for conditions of transplanting.

506 Petrasovits, I. & Darab, K.
A rizs sótűrésének vizsgálata. **(Studies on the salt tolerance of rice).**
Agrokémia és Talajtan 1960 : **9** : 89–102.

Details of the effect of Na_2SO_4, Na_2CO_3 and $NaHCO_3$ upon germination, plant height, root length, dry weight, water content and ash content in seven varieties are given. Varietal differences in sensitivity during germination were detected, Uzrosz 17 and Dunghan Shali being the most tolerant. Dunghan Shali was particularly tolerant of Na_2CO_3.

507 Oka, H.-I.
Variation in competitive ability among rice varieties. (Phylogenetic differentiation in cultivated rice XIX).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 61–68.

Varieties of the Continental (*indica*) type generally compete better than Insular (*japonica*) varieties, both against other rice varieties and against weeds. Bulk-propagated hybrid progenies tend to compete better than pedigree populations. Little correlation was observed between competitive ability and other agronomic characters. By partitioning variance components, it could be inferred that competitive ability is inherited but the F_3 variances were too large to permit an estimation of the number of effective factors. [Cf. XXIX, 3911].

508 Yamada, N.
(Physiological studies on the resistance of rice to the deleterious effects of submersion).
Nogyo Gijutsu Kenkyusho Hokoku/Bull. Nat. Inst. agric. Sci. : Ser. D. 1959 : **34** : No. 3 : Pp. 110. [Japanese].

From the physiological investigations reported here, it is concluded that resistance to damage by submersion depends on (1) a high content of respiratory substrate (carbohydrate and protein) and a low rate of respiration. These conclusions were supported by comparative trials with 36 varieties.

It is noted however that high protein content tends to be associated with high rate of respiration.

509 Bhapkar, D. G., Kulkarni, N. B. & Chavan, V. M.
Bacterial blight of paddy.
Poona agric. Coll. Mag. 1960 : **51** : 36–46.

Tabulated information is given on the susceptibility of 55 varieties of rice, and 5 species of *Oryza* to *Xanthomonas oryzae* under field conditions in Maharashtra. Substantial resistance was noted in BAM9 and MTU15, while *O. sativa* var. *spontanea* showed only a trace of infection.

510 du Pasquier, R.
Riziculture en Iran. **(Rice cultivation in Iran).**
Riz et Rizic. 1960 : **6** : 5–10.

Reasons for the comparative lag in the expansion of rice cultivation in Iran are explained. Local varieties are predominantly grown at present and fall into 4 types, Sadry, Ambardou, Kardeh and Champa. *Helminthosporium oryzae* (*Cochliobolus miyabeanus*) is a serious pathogen; since 1954–1955, trials studying the resistance of local and foreign varieties have been in progress and 10 of the latter are currently being multiplied. It has been noted that some local susceptible varieties suffer a loss in yield when manure is applied. Other trials have sought to determine the varieties best suited for specific areas.

511 Uehara, K.
(On the production of phytoalexin by the interaction between rice and *Piricularia oryzae*).
Nihon Shokubutsubyori Gakkai Ho/Ann. phytopath. Soc. Japan 1958 : **23** : 127–30. [Japanese].

Phytoalexin was produced in greater quantity in drops of a conidial suspension of the pathogen applied to detached leaves of the resistant varieties Norin 22 [Ministry of Agriculture and Forestry 22] and Kameji than in drops on the susceptible varieties Asahi [Rising Sun] and Omachi.

512 Lin, K.-M. & Lin, P.-C.
(Variation in blast resistance of rice induced by irradiation treatment).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 19–22. [Japanese].

[Cf. XXX, 1597].

513 Marks, G. C. & Peiris, J. W. L.
Review of experiments on tests of varietal resistance of Ceylon paddy to blast caused by *Piricularia oryzae* (Cav.).
Trop. Agriculturist 1959 : **115** : 37–40.

The method used for testing varieties for reaction to leaf blast under upland conditions is outlined [cf. XXX, 2732]. Varieties graded as moderately resistant, resistant or highly resistant under such conditions have all proved extremely resistant to neck rot, panicle blast and node blast in inundated soils, irrespective of the locality of these soils. It has so far proved satisfactory to test new hybrids for leaf-blast resistance at a few stations under upland conditions in the early generations, with final tests for neck-rot resistance before release for multiplication. It is pointed out that testing for blast resistance in upland localities has the following defect. Under such conditions silicification of the leaf epidermis is restricted; the mechanical resistance offered by the epidermis to entry of the pathogen is therefore not tested by this method, only physiological resistance being determined. The nature of the latter type of reaction is discussed.

514 FERNANDO, L. H. & WEERARATNE, H.
High yielding varieties of rice resistant to blast.
Trop. Agriculturist 1959 : **115** : 179–81.
Information is given on the degree of blast resistance of improved varieties recommended by the Department of Agriculture in Ceylon. H–4 (Murungakayan 302 x Mas), H–105 (C–104 x Murungakayan) and H–501 (GEB 24 x Vellai Illankalayan) are of particular interest, combining a high degree of resistance with high response to fertilizer.

515 VAN, T. K. & GOH KEE GUAN
The resistance of *Oryza ridleyi*, Hook., to padi stem borer attack.
Malay. agric. J. 1959 : **42** : 207–10.
Tests in Malaya have shown that *O. ridleyi* is much more resistant to the stem borer than is *O. sativa*. The possible genetic basis of this resistance was not determined; it is known however that the stem of *O. ridleyi* has a thick sclerenchymatous layer between the epidermis and the pith.

516 BHAT, M. V., PATEL, G. A. & GOKAVI, M. A.
Investigations on paddy gall midge (*Pachydiplosis oryzae* W.M.). Part II. Varietal resistance to gall midge.
Indian J. Ent. 1958 : **20** : 21–26.
Among nearly 150 varieties studied in row trials in the North Kanara District, India, during 1952–55, the very late, rather low-yielding variety Ratnachudi showed a very low incidence of silver shoot caused by *P. oryzae*; this variety was also resistant in artificial inoculation tests. The early variety Bentawal was also resistant in the field. Among improved varieties, Maskaty 1315 and White Halga 1690 were more resistant than Jaddu 1061 and Red Halga 244. Crosses between Maskaty 1315 and Jaddu 1061 were intermediate between the parents in resistance.

517 RENAUD R.
La maladie de la feuille blanche (hoja blanca). Une nouvelle virose du riz. **[White leaf disease (hoja blanca). A new rice virus].**
Riz et Rizic. 1960 : **6** : 31–37.
White-leaf disease is the first virus disease of rice recorded in the Western Hemisphere. Aspects dealt with in this review include its history and geographical distribution, symptoms, environmental factors influencing pathogenesis, mode of transmission and host range. Other sections deal with attempts to combat the insect vectors and to produce suitable resistant varieties.

518 REVILLA M., V. A.
Observaciones sobre la infermedad "hoja blanca" del arroz en Cuba, Venezuela y Colombia. **(Observations on the white leaf disease of rice in Cuba, Venezuela and Colombia).**
Agronomia, Lima 1958 : **25** : 70–74.
In a Cuban trial 3900 varieties of rice were exposed to white leaf disease, certain unspecified American varieties acting as controls. The number included 2200 varieties belonging to a world rice collection, and of this group 540 varieties proved to be resistant, while another 210 were moderately resistant. The majority of the resistant varieties originated from the Far East and had short grains and dark-green, narrow leaves. Among the US varieties in the trial, those with short and medium grains showed resistance, while the more widely grown, large-grained varieties were susceptible except for Colusa, a variety introduced from Italy, but originally from China.

519 BEACHELL, H. M. *ET AL.*
Breeding rice varieties for resistance to the virus disease hoja blanca.
News Lett. FAO Internat. Rice Comm. 1959 : **8** : No. **3** : 6–9.
Work on testing and breeding varieties for resistance to white leaf in the USA and Latin American countries is outlined. It has been found that resistance may be transferred to varieties of all grain types commonly grown in the USA. Parents which have proved useful as sources of resistance are indicated.

MINOR CEREALS

520 GRANT, W. F.
Cytogenetic studies in *Amaranthus*. III. Chromosome numbers and phylogenetic aspects.
Canad. J. Genet. Cyt. 1959 : **1** : 313–28.
Chromosome numbers are reported for 30 species of *Amaranthus*, of which eight species are reported for the first time. Of these, four have $2n = 32$, namely, *A. acutilobus*, *A. angustifolius*, *A. aureus* and *A. mantegazzianus*; while four have $2n = 34$, namely, *A. berlandieri*, *A. crispus*, *A. deflexus* and *A. lividus*. New chromosome number determinations are also reported

for *A. cruentus* and *A. powellii*; both have $2n = 34$. The chromosome numbers are reported for two natural interspecific hybrids, *A. cruentus* x *A. hybridus*, $2n = 34$, and *A. cruentus* x *A. powellii* x *A. retroflexus*, $2n = 32$. It is noted that with the exception of one tetraploid species (*A. dubius*, $2n = 64$), somatic chromosome numbers of 32 and 34 are found in all sections of the genus. The number of species with $n = 16$ is approximately equal to the number with $n = 17$. It is suggested that 16 may be the basic number, and that an increase from 16 to 17 might account for certain taxonomic abnormalities in the genus. Within the populations studied differences in the basic number of chromosomes have been found to be associated, to some extent, with habitat preference.

At least half of the species of the genus have been involved in hybridization, according to a survey of the natural interspecific hybrids reported in the literature. The aneuploid condition has apparently arisen as a result of interspecific hybridization, and together with the latter has been a major factor leading to species variation, speciation, and the taxonomic complexities of the genus.

521 MURAKAMI, M. & HARADA, K.
(Studies on the improvement by means of breeding of the genus *Coix*. II. On tetraploid *Coix* raised by colchicine treatment).
Kyoto Daigaku Gakujutsu Hokoku : Nogaku/Sci. Rep. Kyoto Univ. : Agric. 1959 : No. 11 : 1–8. [Japanese].

Colchicine-induced tetraploids of var. *ma-yuen* and of the F_1 hybrid between this variety and typical *C. lachryma-jobi* have been obtained. They are of practical interest as forage crops, especially the latter, on account of their more prolific foliage production in comparison with the diploids. [Cf. XXX, 1599].

522 MURAKAMI, M. & TAKEOKA, M.
(Studies on the improvement by means of breeding of the genus *Coix*. III. On the surface structure of the pollen membrane of the genera *Coix* and *Zea*).
Kyoto Daigaku Gakujutsu Hokoku : Nogaku/Sci. Rep. Kyoto Univ. : Agric. 1959 : No. 11 : 9–14. [Japanese].

Microscopic and electron microscopic observations on the pollen of maize and $2x$ and $4x$ *C. lachryma-jobi* are reported. The grains of all the forms studied were closely similar though minute differences were detected in spinule dimensions and the germ pores.

FORAGE GRASSES

523 **Grass, clover and lucerne trials in O.E.E.C. countries.**
OEEC, Paris 1960 : No. 23 : Pp. 232.

The report is presented of tests carried out on a comprehensive range of grass and clover varieties during 1956–58 in 15 OEEC member countries. The varieties belonged to *Lolium perenne*, *Dactylis glomerata*, *Festuca pratensis*, *Phleum pratense* and *Trifolium pratense*. The trials comprised three stages: (1) preliminary classification and identification of varieties in spaced-plant tests, (2) agrotype trials with swards for further classification and (3) agronomic trials to obtain preliminary data on the agricultural value of the varieties under certain managements.

524 LAUTOUR, G. DE
A leaf squash technique for chromosome studies in grasses.
NZ J. Sci. 1960 : **3** : 293–97.

The following method has given good results with *Agropyron repens*, *Anthoxanthum odoratum*, *Lolium* spp., *Lolium* spp. x *Festuca arundinacea*, *Pennisetum clandestinum*, *Phleum* sp. and *Poa annua*. Leaf buds dissected from young tillers were pretreated with colchicine solution or other spindle inhibitors. After fixation, portions of leaf tissue were stained by the Feulgen technique and macerated by pectinase treatment.

525 SCHUMANN, G.
Eine neue Methode zur Colchicinierung von Gramineen und grosskörnigen Leguminosen. **(A new method for treating the Gramineae and large-seeded legumes with colchicine).**
Züchter 1960 : **30** : 118–20.

Various methods of applying colchicine to grass species described in the literature have been tried without success and the results are briefly reported. An improved method is presented, consisting in removing the caryopsis from a germinating seedling and applying colchicine in tragacanth jelly to the point at which the caryopsis had been removed. In this way 18 polyploids were obtained from 45 individuals of *Lolium perenne* treated. Precautions are taken to prevent the colchicine from penetrating the soil and the seedlings are kept moist by covering the dish in which they are growing for 24 hr.

after the operation. The optimal colchicine concentration varies according to the species from 0·25 to 0·1%. From 38 rye seedlings treated with 0·25%, 31 survived, 29 of them showing significant increases in size of stomata. Examinations of root tips showed them to be mostly mixochimeras.

Similar treatments of *Vicia faba* with 0·25% colchicine produced 7 tetraploid and 8 mixoploid plants. Most of the side shoots as well as the main shoot had polyploid tissue.

The method can be applied also to tubers by removing a portion of the flesh under the eye and applying the colchicine jelly.

526 Ghosh, A. N. & Knowles, R. P.
Scissor emasculation of grasses.
Agron. J. 1960 : **52** : 366–67.

The method used by Wells and Caffey for cereals [cf. XXVII, 1550] has proved effective for *Bromus inermis*, *Agropyron cristatum*, *A. intermedium* and *Elymus junceus*. Treatment with alcohol to hasten decay of the clipped anthers offered no advantage over scissor emasculation alone.

527 Rosengurtt, B., Arrillaga, B. R. & Sierra de Soriano, B.
Caracteres vegetativos y forrajeros de 175 gramíneas del Uruguay. **(Vegetative and forage characters of 175 grasses of Uruguay).**
Rev. Fac. Agron. Montevideo 1960 : 3–21.

Detailed descriptions and a key to identification are given.

528 Bowden, W. M.
Chromosome numbers and taxonomic notes on northern grasses. III. Twenty-five genera.
Canad. J. Bot. 1960 : **38** : 541–57.

Among the 2*n* numbers reported mainly for Canadian collections, are the following: *Agrostis borealis*, 56; *A. gigantea*, *A. perennans*, *A. scabra*, 42; *A. palustris*, 30; *A. tenuis*, 28, 32, 34; *A. canina*, 14; *Alopecurus aequalis*, 14; *A. geniculatus*, *A. pratensis*, 28; *A. alpinus*, 105, 112, 119; *A. occidentalis*, 112; *Danthonia compressa*, *D. spicata*, 36; *Deschampsia brevifolia*, *D. elongata*, 26; *D. caespitosa*, 26, 27, 28; *D. flexuosa*, 28, 32; *D. pumila*, *ca.* 39; *Panicum xanthophysum*, 36; *Phalaris arundinacea*, 28; *Phleum alpinum*, 18; and *Ph. pratense*, 42. Species belonging to *Ammophila*, *Calamagrostis*, *Cinna*, *Hierochloe*, *Koeleria*, *Leersia*, *Milium*, *Muhlenbergia*, *Nardus*, *Oryzopsis*, *Sieglingia*, *Sorghastrum*, *Spartina*, *Sphenopholis*, *Sporobolus*, *Stipa* and *Trisetum* were also examined. [Cf. XXX, 4023].

529 Childers, W. R.
Orchard grass breeding.
Forage Notes, Ottawa 1960 : **6** : No. 2 : 19–22.

Methods used in improving *Dactylis glomerata* during the past four decades at Ottawa are described. The development of a winter-hardy late leafy pasture type has been the main aim. Application of the polycross technique has resulted in two promising synthetics, Ottawa 100 and 200.

530 Reyntens, H. & De Loose, R.
L'action mutagénique du phosphore radio-actif (^{32}P) chez *Dactylis glomerata*—Lemba R.v.P. **(The mutagenic action of radioactive phosphorus (^{32}P) on *D. glomerata* 'Lemba R.v.P.').**
Rev. Agric., Brux. 1960 : **13** : 190–206.

Observations were made on the R_1, R_2 and R_3 of treated plants, and tabulated information is given on percentage assimilation of the mutagen, mortality, chlorophyll mutants, number of inflorescences produced and number of seeds per inflorescence. The ultimate aim of the experiments was to attempt to eliminate by mutation the crinkling of the leaf caused by silicic acid crystals in the leaf margins and median nerve. Of 17,000 R_2 plants from selfed and open-pollinated parents, 3 and 23 plants respectively showed reduced crinkling. Five of the latter were dwarf. The progenies of selfed R_2 plants are still under observation.

531 Knight, R.
The growth of cocksfoot (*Dactylis glomerata* L.) under spaced plant and sward conditions.
Aust. J. agric. Res. 1960 : **11** : 457–72.

An attempt has been made to assess the accuracy with which yield data obtained from spaced plants may be used to predict the yield of the same genotype in swards. The trial comprised nine clones, of which seven were derived from plants from the Mediterranean region, while two were of British origin. The results, in general, showed very little correlation between the growth of spaced and sward plants; it is suggested that varying responses to limiting factors, such as light, may have caused the sward clones to react differently. A high mortality was observed during the summer in the two British clones, while mortality was negligible among the Mediterranean plants.

532 DHAWAN, C. L.
Combining ability in timothy.
Diss. abstr. 1959 : **20** : LC Card Mic 59–4134 : 1517–18. (Abst.).

At Purdue University a study was made of six clones and their S_1s, polycrosses, single crosses and "mutual pollinations (containing both hybrid and selfed seed)", 5-clone synthetics involving these clones, the 6-clone synthetic and Drummond (control). General combining ability was determined for plant vigour, regrowth, height, leafiness, vigour, stem-rust resistance, crown width, and forage yield. The S_1s showed a general improvement over the clones for all characters except stem-rust resistance, the S_1s being susceptible. Polycross performance gave the best estimate of general combining ability for vigour, regrowth, crown width, height and yield. Both polycross and S_1s were efficient in predicting general combining ability for leafiness and stem-rust resistance. No significant disparities were observed between the 6-clone synthetic and 5-clone synthetics. Inclusion or exclusion of any one of the six clones did not significantly affect synthetic performance. The 6-clone synthetic did not differ significantly from Drummond. Specific combining ability and heterosis for height and yield were studied in 15 single crosses. Significantly positive specific combining ability was shown by six single crosses for height and by four for yield. The clones from which these single crosses were produced also had high general combining ability. Some of these single crosses displayed a high degree of hybrid vigour, yielding 50–170% more than the parents and up to 45% more than Drummond. Progenies from the mutual pollinations gave a good performance, suggesting the possible commercial value of using limited-generation hybrids.

533 HEIN, M. A.
Registration of varieties and strains of bromegrass (*Bromus* ssp.) IV.
Agron. J. 1960 : **52** : p. 406.

Recently registered by the US Department of Agriculture and American Society of Agronomy, *B. inermis* 'Manchar Smooth' [cf. XX, 332] and *B. mollis* 'Blando' [cf. XXVI, 2431] are described.

534 CARNAHAN, H. L. & HILL, H. D.
The nature of polyploidy in smooth bromegrass.
J. Hered. 1960 : **51** : 43–44.

In a cross between polyhaploid *Bromus inermis* ($2n = 28$) and the normal octoploid ($2n = 56$), an exceptional octoploid plant occurred within the predominantly hexaploid F_1 population. This plant was pollinated with a mixture of pollen from several representative normal octoploid plants.

In order to determine the genome model of the polyhaploid parent, and of octoploid *B. inermis*, the frequencies of micronuclei were counted in the progeny of this cross. The results showed that the chromosomes from the polyhaploid parent were similar to those in octoploid *B. inermis*, as they did not contribute to abnormal frequencies of micronuclei in the F_1 hybrids. These results, together with previous work [cf. XXVIII, 578], are in harmony with the interpretation that octoploid *B. inermis* is an autoallopolyploid, AAAABBBB, in which considerable, but far from complete, diploidization has occurred.

535 NIELSEN, E. L.
Cytology and fertility of small plants of *Bromus inermis*.
Bot. Gaz. 1960 : **121** : 133–39.

A study of microsporogenesis in nine "small" plants, i.e. short plants with weak, spreading habit which tiller poorly and set little seed, revealed irregularities such as inversions, translocations, precocious separation, lagging, stickiness and cenocyte formation. It is considered that the high degree of pollen sterility found is not entirely attributable to meiotic abnormalities since these also occur to some extent in normal plants where pollen stainability is frequently greater than expected from behaviour at earlier stages of meiosis.

536 REYNTENS, H. & DE LOOSE, R.
L'influence du degré hygrométrique de la semence sur la sensibilité aux rayons X du ray-grass anglais (*Lolium perenne*) type à pâturer R.v.P. [**The influence of the moisture content of the seed on the sensitivity to X rays of R.v.P. pasture-type perennial ryegrass (*L. perenne*)**].
Rev. Agric., Brux. 1960 : **13** : 532–36.

This study has shown that perennial ryegrass seeds should be kept at a relative humidity of 65–80% before and during exposure to X rays. Within this range the greatest resistance is offered to adverse effects induced by the irradiation, such as poor seed viability and low seedling vigour. The maximum sensitivity to irradiation occurred at relative humidities of 0 and 95–100%.

537 Green, J. O. & Eyles, J. C.
A study in methods of grass variety testing.
J. Brit. Grassl. Soc. 1960 : **15** : 124–32.

Work on five varieties of perennial ryegrass at the Grassland Research Institute, Hurley, England, has shown that varieties may be classified according to leafiness and rate of maturity, on the basis of spaced-plant measurements alone. Such measurements, it is suggested, may be a more accurate guide to performance than a limited number of sward trials [cf. XXVII, 3052].

538 van Bogaert, G.
Méthodes en vue de la détermination de la valeur génétique de plantes mères chez le ray-grass anglais. (**Methods aimed at determining the genetic value of mother plants in perennial ryegrass).**
Rev. Agric., Brux. 1960 : **13** : 538–40.

A comparison of methods of identifying superior genetic material is reported. It was found that as good an estimate of the potentiality of a particular variety could be obtained from row yield measurements as from visual and yield estimations on individual plants.

539 Buckner, R. C.
Cross-compatibility of annual and perennial ryegrasses with tall fescue.
Agron. J. 1960 : **52** : 409–10.

Relatively large numbers of hybrids were obtained at the Kentucky Agricultural Experiment Station by bagging nonemasculated spikes of ryegrass together with a detached panicle of tall fescue (*Festuca arundinacea*) as pollen source. Plants bearing panicles were assumed to be hybrids, since Crowder found that the panicle of *Festuca* was dominant over the spike of *Lolium* [cf. XXIV, 2073]. Hybrids were more readily obtained from crosses with annual than perennial ryegrass. Individual plants of tall fescue differed in degree of intergeneric compatibility, as shown by the results of pollinating annual ryegrass.

540 Brougham, R. W., Glenday, A. C. & Fejer, S. O.
The effects of frequency and intensity of grazing on the genotypic structure of a ryegrass population.
NZ J. agric. Res. 1960 : **3** : 442–53.

The material studied in investigations in New Zealand was vegetatively derived from plants surviving from (1) a sowing of short-rotation ryegrass (*Lolium perenne* x *L. multiflorum*) and red and white clovers which had been subjected to four sheep-grazing systems for about two years and (2) single-spaced plants grown from the same seed lot. Changes in the original population according to the grazing system were determined from observations on morphological characters of the plants in boxes and later in the field. In addition, the fluorescence test was made. As shown by plant means, selection had occurred within the original population towards *L. perenne* types under frequent and intensive grazing and towards *L. multiflorum* types under less frequent and less intensive grazing. These trends were also shown by the genetic components of the plant variances. The results from the fluorescence test also suggested a shift towards the *L. perenne* types, since frequent and intensive grazing caused more deaths of fluorescent plants than of nonfluorescent ones. The results are discussed in relation to the rapidity of response to the management systems applied, the adaptability of strains with a wide genotypic basis under different systems, the different reactions of *L. perenne* and *L. multiflorum* types to various managements and the value of simply inherited characters such as the fluorescent response and awning in genecological analysis of ryegrasses.

541 Cooper, J. P.
Selection and population structure in *Lolium*. IV. Correlated response to selection.
Heredity 1960 : **14** : 229–46.

In further investigations at the Welsh Plant Breeding Station, Aberystwyth, observations were made on ear characters in initial populations of the perennial ryegrasses Irish and Kent and in three generations of families selected for early and late ear emergence [cf. XXX, 2754]. Total length (from the flag-leaf node to the tip of the inflorescence), ear length, spikelet number and length of the empty glume were highly heritable in both strains, with considerable additive genetic variation. Floret number and length of spikelet showed little variation in Irish but more in Kent; the three last-mentioned measurements were made on the sixth spikelet from the inflorescence tip. The ear-length group of measurements (total length, ear length and spikelet number), but not the spikelet measurements, were affected by a marked inbreeding depression. The four-way mating system, based on four unrelated plants, was however sufficient to maintain vigour for all characters during the three generations of selection. The corresponding phenotypic and genetic correlations for clones of both strains used as parents in pair crosses were usually of the same order and in the same direction. Significant correlations between date of ear emergence and the various ear measurements in the initial populations were few. The changes in ear characters which occurred as a result of selection for date of ear emergence bore no regular relation to the genetic correlations calculated from the initial material. It is suggested that these changes are the outcome of either chance association of genes in the parents selected in each generation or of linkage.

542 Jain, H. K.
Induced neo-centric activity in chromosome ends.
Chromosoma 1960 : **11** : 310–12.

Several plants of a clone of *Lolium perenne* showed abnormal chromosome behaviour in PMCs after being kept for 86 hr. at 33 ± 2° C. The development of bivalents was arrested at diplotene and they became arranged on a precociously formed metaphase plate; the chromosomes did not show the high degree of condensation usual at metaphase and a normal-sized nucleolus was still present. The metaphase arrangement was achieved by the activity of the chromosome ends, the true centromeres remaining passive. In most of the affected cells the chromosomes showed stickiness and were clumped. Coorientation of the terminal parts of the bivalents instead of that of the centromeres prevented regular anaphase separation; the chromosomes broke and the fragments formed restitution nuclei, nonviable pollen grains being obtained. The occurrence of induced neocentric activity indicates that the centromere is not essentially different from other chromomeres which can take up its function. Darlington suggested that the special properties of the centromere are due to starvation of nucleic acid; in *Lolium* the stickiness of the chromosomes associated with neocentric activity may be due to depolymerization of DNA.

543 Jain, H. K.
Experimental modification of centromere activity.
J. Hered. 1960 : **51** : 47–50.

An examination of pollen mother cells from a *Lolium perenne* clone which had been subjected for 38 hr. to a temperature of 31 ± 2° C. showed that the bivalents assembled in the equatorial region without coorientation of their centromeres; this behaviour is inconsistent with Östergren's hypothesis that chromosome co-orientation and assembling are controlled by the same force of attraction from the poles [cf. XXI, 1556]. Associated with failure of co-orientation was poor development of the spindle due to inadequate production of fibre elements. The ability of the chromosomes to synthesize nucleolar material adventitiously [cf. XXVII, 4088] appeared to be negatively correlated with the normal functioning of the centromeres, and the possibility is suggested that heat treatment may induce the centromeres to associate themselves with the synthesis of nucleolar material at the expense of their normal activities.

544 Fejer, S. O.
Ear emergence in perennial ryegrass as affected by differences in light and temperature before ear initiation.
NZ J. agric. Res. 1960 : **3** : 558–64.

From glasshouse experiments conducted at the Grasslands Division of the New Zealand Department of Scientific and Industrial Research, it was concluded that as a general rule uniform and early flowering may be secured by growing the plants first in the normal short days of the winter at low temperature (*ca.* 60° F. day, 40° F. night temperature) and later in heated glasshouses (*ca.* 70° F. day, 50° F. night temperature) in which the day length is artificially extended to 16 hr. by light of low intensity, that is, by accelerating the natural sequence of day-length and temperature conditions. Genotypical differences in response to this treatment may however be expected.

545 Davies, A.
The growth of varieties of perennial ryegrass in the seeding year.
J. Brit. Grassl. Soc. 1960 : **15** : 12–20.

Shoot-weight differences between varieties during the first winter after sowing are shown to arise from relative differences in seed size, rate of tillering, size of tillers and cold tolerance.

546 Cooper, J. P.
Short-day and low-temperature induction in *Lolium*.
Ann. Bot., Lond. 1960 : **24** : No. 94 : 232–46.

The requirements for floral induction were studied in outbreeding populations of *L. perenne*, *L. multiflorum* and *L. rigidum* at the Welsh Plant Breeding Station, Aberystwyth. Heading could be brought about by either low temperature (0–3° C.) or short day (8 hr.) independently, but short day was ineffective at low temperatures. Inductive requirement varied with the climatic and agronomic origin of the population.

Varietal differences in response to short day corresponded with those in reaction to low temperature and appeared to be related to the annual or perennial habit. Within each population, considerable genetic variation in inductive requirement could be detected and, as shown by experiments on *L. rigidum* 'Wimmera' and *L. perenne* 'Irish' and 'Kent', it was possible to obtain a rapid response to selection. No such genetic variation was found within single lines of autogamous *L. temulentum.*

547 Skvorcov, A. K.
(An interspecific hybrid of *Festuca rubra* L. x *F. longifolia* Thuill.).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **131** : 951–53. [Russian].

A morphological description of the F_1 of the above hybrid, characterized by a high degree of sterility, is given.

548 Buckner, R. C.
Use of polyethylene tubes for selfing tall fescue.
Agron. J. 1960 : **52** : 410–11.

The use of polyethylene tubes supported by wire frames and enclosing the entire plant, in selfing *Festuca arundinacea* at the Kentucky Agricultural Experiment Station, is described. The advantages of this technique are: (1) comparatively large numbers of plants may be inbred with relatively small expenditure of labour, and (2) sufficient seed may be obtained to produce enough plants to establish replicated progeny tests with several plants per replicate.

549 **We've pretested fescue palatability.**
Agric. Res., Wash. 1960 : **9** : No. 2 : 12–13.

A Kentucky study of inbred lines derived from a local naturalized strain of tall fescue has shown that commercial varieties may contain plants with a wide range of palatability. Unpalatable but otherwise desirable types could be rapidly improved by crossing with palatable lines. Inbreds were found to differ in their ability to transmit palatability.

Valentine, D. H.
Symposium on experimental taxonomy of vascular plants. Linnean Society, 6th March, 1959.
Proc. Linn. Soc. Lond. 1960 : **171** : 122–38.

A symposium on Experimental taxonomy of vascular plants held by the Linnean Society of London, 6 March 1959, included the following contribution:—

550 *Wilkins, D. A. Recognizing adaptive variants. (pp. 122–26).*

A discussion of the general problems of recognizing adaptive variants under wild and experimental conditions is followed by an account of the findings of investigations at the Scottish Plant Breeding Station on lead tolerance in *Festuca ovina* growing on waste tips from old lead mines in England and Wales. According to observations on rate of root growth in culture solutions containing lead nitrate, the species probably comprises three types: (1) normal, lacking in tolerance, (2) medium tolerant and (3) highly tolerant. Tolerant plants originated from soils containing up to 4% lead and all nontolerant ones from soils containing very little. Data from crosses, in all possible combinations, between plants representing the three types indicated that tolerance was completely dominant. Possibly only one major gene is involved. No morphological difference distinguished tolerant from nontolerant individuals. Tolerance was associated with some other unknown character which weakened tolerant plants in ordinary soil; tolerant plants have never been discovered away from a lead tip. It is suggested that the tolerant form arose through mutation independently in various widely separated areas.

551 Bennett, H. W. & Bashaw, E. C.
An interspecific hybrid in *Paspalum.*
J. Hered. 1960 : **51** : 81–85.

Interspecific hybrids were obtained by crossing *P. dilatatum* ♀ ($2n = 50$), which is completely susceptible to *Claviceps paspali*, with *P. malacophyllum* ♂ ($2n = 40$), which is immune, using a technique described previously [cf. XXIX, 3949]. In the F_1 plants $2n = 70$, indicating fertilization of an unreduced ovum of *P. dilatatum*; meiosis was highly irregular and seed set was low. The plants exhibited heterosis and were highly resistant to *C. paspali*.
Three F_2 plants, 1431, 1432 and 1433, examined for chromosome number and disease reaction, were found to have $2n = 52$, 54 and 65 respectively and to be immune, immune and highly resistant respectively. It is suggested that *P. malacophyllum* could be an ancestor of *P. dilatatum.*

552 DeSelm, H. R.
Variation in *Andropogon gerardi* Vitman and *A. scoparius* Mx. in two Ohio prairie areas.
Diss. Abstr. 1960 : **20** : LC Card Mic 59-5373 : 2510–11. (Abst.).

A report is given of investigations on intraspecific variation in *A. gerardi* ($2n = 60$) and *A. scoparius* ($2n = 40$) occurring north and south of the glacial boundary, with respect to germination, stem elongation and flowering under greenhouse conditions and morphology.

553 Hirayoshi, I., Nishikawa, K., Kubino, M. & Sakaida, T.
(Cytogenetical studies on forage plants. VII. On chromosome conjugation and fertility of F_1 hybrids involving *Miscanthus sinensis*, *M. sinensis* var. *condensatus* and *M. tinctorius*).
Gifu Daigaku Nogakubu Kenkyu Hokoku/Res. Bull. Fac. Agric. Gifu Univ. 1959 : No. 11 : 86–91. [Japanese].

F_1 hybrids between the above taxa are intermediate morphologically between their parents. The modal meiotic configuration in all cases is 19_{II}; the hybrids, like their parents, are self incompatible but F_2 seed is easily obtained by outpollination. [Cf. XXIX, 2726].

554 Joshi, A. B. & Patil, B. D.
Male-sterile off-type plants in the pasture grass, *Sehima nervosum* Stapf.
Curr. Sci. 1960 : **29** : 285–86.

Data from crosses involving two ♂-sterile plants suggested that ♂ sterility was of the extranuclear type and reproduction in *S. nervosum* completely sexual. In both plants, meiosis during microsporogenesis was normal ($n = 20$), but pollen-grain development was much retarded. In one plant, none of the anthers extruded, while in the other, the anthers in the upper florets of the spikelets extruded but not those of the lower florets. This distinction between the two ♂-sterile plants was maintained in their clonal progenies.

555 Nishikawa, K., Matumura [Matsumura], M., Fujimitsu, S. & Hirayoshi, I.
(Studies on breeding sorgo hybrids. V. The relation between ear temperature and the temperature required in hot-water emasculation of the ears).
Gifu Daigaku Nogakubu Kenkyu Hokoku/Res. Bull. Fac. Agric. Gifu Univ. 1958 : No. 9 : 74–80. [Japanese].

The temperature required for hot-water emasculation (10 min. duration) rises with initial ear temperature, being 44–45° C. for an initial temperature of 20–21° and 48–49° for an initial temperature of 31–32° [cf. XXVII, 3063].

556 Bhatti, A. G., Endrizzi, J. E. & Reeves, R. G.
Origin of Johnson grass.
J. Hered. 1960 : **51** : 107–10.

Among tetraploid derivatives obtained from a cross between *Sorghum vulgare* and the weakly rhizomatous *S. virgatum* were a number of plants showing strongly rhizomatous growth. The cytological behaviour of these tetraploids was shown to be identical to that of Johnson grass, *S. halepense.* It is suggested that Johnson grass arose as a result of the doubling of chromosomes of a natural hybrid between *S. vulgare* and *S. virgatum* in the Mediterranean region of North Africa.

557 Sotomayor-Ríos, A., Schertz, K. F., Woodbury, R. & Vélez Fortuño, J.
Taxonomic description and reproductive behavior of Giant Pangola (*Digitaria valida* Stent).
J. Agric. Univ. PR 1960 : **44** : 53–59.

A morphological description is given of the above variety, which had $2n = 42$, this number being different from the counts previously reported for the species. Microsporogenesis was highly irregular, being characterized by multivalents, lagging univalents and micronuclei; only 2·3% of the pollen grains were completely stainable. No degeneration was observed during megasporogenesis but was usually apparent after megaspore formation. It is concluded that the chromosomal irregularities may be sufficient to cause the very low seed set and that this low fertility will limit the utilization of the variety in breeding.

558 Lazarides, M.
The Australian species referred to *Ichnanthus* Beauv. (Gramineae).
Aust. J. Bot. 1959 : **7** : 328–46.

The view is expressed that the genus *Ichnanthus* is represented in Australia by the single species *I. vicinus.* It is proposed that *I. majusculus*, *I. pauciflorus*, *I. australiensis* and *I. muelleri* be referred to the genus *Panicum.* The position of *I. oblongus* remains uncertain.

559 Bogdan, A. V.
The breeding behaviour of molasses grass in Kenya.
E. Afr. agric. For. J. 1960 : **26** : 49–50.

Observations on four types of *Melinis minutiflora* established that the species does not require cross pollination for seed formation, although cross pollination may occur very occasionally. Embryological investigations are needed to determine whether the species is apomictic.

560 MARKARIAN, D. & SCHULZ-SCHAEFFER, J.
An efficient technique for making crosses between annuals and perennials.
J. Hered. 1960 : **51** : p. 34.

In the polycross progeny of a cross between an annual and a perennial species of *Alopecurus*, hybrids were recognized by observing the persistence of plants grown from seed taken from the annual parent. In the second growing season after they were sown, only a few plants remained and these closely resembled the annual parent except that they were perennial. The hybrid nature of these individuals was confirmed, since their chromosome number was intermediate between that of the two parent species. It is suggested that this technique will operate where one parent is an annual and the other a perennial, assuming that the perennial habit persists in the F_1.

561 WÖHRMANN, K.
Untersuchungen über die Auswirkung der Inzucht auf einige Merkmale von *Alopecurus pratensis* L. (**Investigations on the effect of inbreeding on some characters of *A. pratensis* L.**).
Züchter 1960 : **30** : 88–92.

With respect to plant length and number of ears per plant, inbreeding depression first appeared in the I_2 and then increased in subsequent inbred generations. Seed set in the I_1 was 75–80% of that of the original plants and nonselfed controls. The inbred generations (I_1–I_7) showed more variability than nonselfed controls in all the characters studied and a few lines showed no decrease in vigour and fertility. Plant length and ear number were greatly influenced by environmental conditions.

562 KNEEBONE, W. R.
Size of caryopses in buffalograss (*Buchloe dactyloides* (Nutt.) Engelm.) as related to their germination and longevity.
Agron. J. 1960 : **52** : p. 553.

Seeds with large caryopses were found to produce more vigorous seedlings than those with small caryopses. However, their germination percentage was no better and they did not remain viable for a longer period.

563 POHL, R. W.
Morphology and cytology of some hybrids between *Elymus canadensis* and *E. virginicus*.
Proc. Ia. Acad. Sci. 1959 : **66** : 155–59.

Hybrids in a road-side colony were uniform and intermediate between the parents, *E. canadensis* and *E. virginicus*, in width and thickness of the glumes, pubescence of the lamina, length and curvature of the awn, and erectness of the spike; fertility was about 5%. From 48 seeds, 37 plants showing a wide range in these characters were obtained, but none exactly resembled the parents. Meiosis in these plants was fairly regular, but differences in chromosome length were evident in some pairs.

564 CHENNAVEERAIAH, M. S. & SARKAR, P.
Chromosomes of *Heteranthelium piliferum* Hochst.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : p. 42.

H. piliferum ($2n = 14$) respectively resembles *Eremopyrum*, *Aegilops* and *Hordeum* in its mode of spikelet disarticulation, awns and glumes. Its caryotype is described. The suggestion is made that this species should be further studied and its relationship with other species in the Hordeeae clarified, in view of the current interest in the transfer of various characters to wheat from related wild species.

565 GROSS, A. T. H.
Distribution and cytology of *Elymus macounii* Vasey.
Canad. J. Bot. 1960 : **38** : 63–67.

An investigation in the Canadian prairie provinces indicated that the sterile hybrid *E. macounii* is widely distributed and occurs in association with *Agropyron trachycaulum* and *Hordeum jubatum*. The evidence suggests that *E. macounii* arises through hybridization between these two species. Using either species as the pollen parent, artificial hybrids were produced and proved to be sterile, and similar morphologically to the natural hybrid. Cytological examination revealed that both the natural and artificial hybrids, as well as the parent species, have $2n = 28$, while an octoploid *E. macounii*, produced with colchicine, has $2n = 56$. Several meiotic irregularities occurring in the various forms studied are described.

566 BOYLE, W. S.
Studies in experimental evolution.
Utah Univ. 1960 : Pp. 23.

The first part of this lecture briefly reviews

current conceptions of mutation, genetic recombination, natural selection and isolation. Investigations on hybridization and polyploidy in the Hordeeae are then reported. A sterile hybrid was produced by artificially crossing *Agropyron trachycaulum* and *Hordeum jubatum*; unlike its parents the hybrid exhibited extremely irregular chromosome behaviour during meiosis. It proved however to be indistinguishable from *Elymus macounii*, suggesting that the latter is merely a first-generation hybrid and not a distinct species. Application of colchicine to the synthetic hybrid resulted in the production of a relatively fertile octoploid, which may perhaps be considered as a new species. Similar fertile polyploids were obtained from hybrids which occurred as a result of natural crossing between *A. subsecundum* and *Sitanion hystrix*.
A sterile hybrid was obtained by crossing *A. trachycaulum* and *S. hystrix* and it is suggested that *A. saundersii* arose by natural hybridization between these two species. Cytological evidence is also presented which indicates that the progenitors of the triploid *A. saxicola* were the diploid *A. spicatum* and the tetraploid *S. hystrix*.

The results of these studies support the suggestion of Stebbins [XXVII, 1871] that the morphological characteristics used to distinguish genera in the Hordeeae fail to reflect true phylogenetic relationships and that the tribe should be regarded as a single genus.

The author has studied the effects of thermal-neutron radiation on the octoploid derived from the hybrid *A. trachycaulum* x *H. jubatum*. Heavy dosages led to low seedling survival while even surviving seedlings had a stunted appearance. An examination of mitosis in root tips of germinating seeds revealed considerable differences in the number of chromosomal bridges induced by the various doses, as well as marked variations in the frequency of cell division. There was some evidence of cumulative as well as immediate effects; the greater the interval between radiation and germination the more pronounced was the inhibiting effect on cell division and growth. One interesting new mutant had an inflorescence with two spikes on one culm as well as a compound leaf, the blades of which each possessed a separate ligule.

X irradiation of barley plants has been used to induce reciprocal translocations following chromosome fracture. Certain results suggest that the genes controlling 2-rowed *v.* 6-rowed spikes and red versus white pericarp are linked and that the translocation observed involves linkage groups I and III.

567 WATANABE, Y., MUKADE, K. & KOKUBUN, K.
Meiotic chromosome behaviours and cross-abilities of some species in the genus *Agropyron*.
Wheat Inform. Serv. Kyoto 1959 : Nos. 9–10 : 28–30.

Meiotic irregularities in *A. elongatum* ($2n = 70$), *A. junceum* ($2n = 28, 42$) *A. glaucum* ($2n = 42$), *A. trichophorum* ($2n = 42$) and *A. campestre* ($2n = 56$) pointed to various degrees of homology between and within the subgenomes. Some irregularities also occurred in *A. elongatum* ($2n = 14$), 2_{I} and $2_{\mathrm{I}} + 1_{\mathrm{IV}}$ being noted in 20% of the PMCs in addition to bivalents. *A. glaucum*, *A. junceum* ($2n = 42$) and *A. trichophorum* were fertile with one another in crosses in both directions. Crossabilities of (1) *A. elongatum* ($2n = 70$), *A. junceum* ($2n = 42$) and *A. trichophorum*, (2) *A. glaucum* and *A. campestre* and (3) *A. elongatum* with common-wheat varieties were respectively classified as (*a*) high, (*b*) low and (*c*) nil.

568 KILCHER, M. R. & LAWRENCE, T.
Quality of intermediate wheatgrass seed, with and without hulls.
Canad. J. Pl. Sci. 1960 : **40** : 482–86.

This study indicated that a higher percentage germination and seedling emergence was obtained from hull-covered seeds of *Agropyron intermedium* as compared with hull-less seeds. The possibilities of selection for more tenacious hulls are mentioned [cf. XXIV, 1170].

LEGUMINOUS FORAGE CROPS

569 TURNER, B. L. & FEARING, O. S.
Chromosome numbers in the Leguminosae. III. Species of the southwestern United States and Mexico.
Amer. J. Bot. 1960 : **47** : 603–08.

The $2n$ numbers given for 43 species include first reports for 42, of which 16 belong to the Mimosoideae. Among the species investigated were the following: *Acacia berlandieri*, *A. rigidula*, *A. schaffneri*, *A. texensis*, *A. tortuosa*, *A. vernicosa*, $2n = 26$; *A. constricta*, $2n = 52$; *Leucaena pulverulenta*, $2n = 56$; *Cassia crotalarioides*, $2n = 28$; *Crotalaria sagittalis*, $2n = 32$; *Lupinus leptophyllus*, $2n = 48$; *Trifolium bejariense*, $2n = 16$; *Astragalus brazoensis*, $n = 11$; *A. distortus* var. *engelmannii*, $2n = 26$; *A. wootonii*, $2n = 24$; and *Desmodium wrightii*, $2n = 22$. [Cf. XXVII, 1886].

570 Hutton, E. M.
Flowering and pollination in *Indigofera spicata*, *Phaseolus lathyroides*, *Desmodium uncinatum*, and some other tropical pasture legumes.
Emp. J. exp. Agric. 1960 : **28** : No. 111 : 235–43.

Ph. lathyroides, *Ph. atropurpureus*, *I. spicata*, *Lotononis bainesii*, *Centrosema pubescens*, *Glycine javanica* and *Stylosanthes gracilis* were found to be cleistogamous in investigations at the Division of Tropical Pastures, Cunningham Laboratory, Brisbane. *D. uncinatum* and *D. sandwicense*, although self compatible, were predominantly cross pollinating. Pollen-tube growth in *I. spicata* and *Ph. lathyroides* on an artificial medium and stigmas of emasculated flowers was governed mainly by the relative humidity, which needed to be about 95% for optimum results. Temperature was a less critical factor, the best pollen development being obtained at 23°–30° C. Crosses within these two species were successful only when the humidity was adjusted to a high value. It is suggested that high humidity may be a characteristic requirement of both tropical and temperate cleistogamous legumes for pollen-tube growth.

571 Birdsong, B. A., Alston, R. & Turner, B. L.
Distribution of canavanine in the family Leguminosae as related to phyletic groupings.
Canad. J. Bot. 1960 : **38** : 499–505.

Combining the results of seed analyses by the authors and other investigators, 219 species representing 109 genera have now been studied with respect to the occurrence of canavanine. This aminoacid has not been found in the Mimosoideae or Caesalpinioideae; in the Papilionoideae it has not been discovered in the Podalyrieae and Sophoreae, while at least one species from each of the other tribes produces canavanine. In three genera, *Vicia*, *Astragalus* and *Glycine*, some species produce canavanine while others do not. These results are interpreted as being of phylogenetic significance.

572 Van Riper, G. E.
Protein differences among varieties of alfalfa and red clover and grass combinations.
Agron. J. 1960 : **52** : 549–50.

In a study of dry-matter and crude-protein differences in Vernal, Ranger and Buffalo lucerne and Dollard, Pennscott, and Kenland red clover, it was found that measurable differences existed among varieties in the production of protein per acre as well as in dry-matter yield. Vernal was significantly superior to Ranger and Buffalo in dry-matter and protein yield during the spring and in protein content during the summer. Dollard was inferior to the other two red clover varieties in summer dry-matter production but exceeded them in protein content, though not in protein yield per acre.

573 Chisci, G. C. & Lessells, W. J.
Relative productivity of six local varieties of lucerne in northern Italy.
Euphytica, Wageningen 1960 : **9** : 81–88.

In tests of six varieties compared over three years at six centres in northern Italy, it was found that at any one centre varieties of local origin gave the highest yields. Apart from this, fairly consistent varietal differences in yield and year-to-year variation were detected.

574 **Creeping alfalfa being developed for Kentucky.**
Crops & Soils 1959 : **12** : No. 3 : p. 20.

Some plants of Rambler lucerne [cf. XXVI, 3100] which were grown in Kentucky were crossed with locally-adapted noncreeping varieties, including Rhizoma, Vernal, Narragansett and a selection from Atlantic. Among the progenies some plants were found which were more vigorous than Rambler, and a few of these spread as much as 2½ ft. and formed 12 new plants.

575 Pergament, E.
A study of quantitative inheritance of height and of yield in *Medicago sativa* L.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–4174 : 1522–23. (Abst.).

A study was made of height and yield in two single-plant selections and their progenies with respect to morphological, anatomical, physiological and genetical aspects. The two selections grew respectively to final heights of 200–225 and 100–125 cm. in the greenhouse. "Differences between the parents in plant height were attributed to the number of cells per unit area and not to the length of cells per unit area. Differences in plant diameter were attributed to cell width per unit area and not to an increase in the number of cells per unit area." The disparity in auxin concentration of the two parents was not significant. Differences in estimates of genotypic variance for height and yield according to the method of analysis used were attributed to (1) type of generation analysed, (2) interaction effects and (3) estimation of environmental variances. As briefly reported previously, a mathematical model was formulated to determine the contribution of each locus to the additive and nonadditive components of the genotypic variance observed in an autotetraploid population [cf. XXX, 1253]. In addition, the effects of multiple allelism, quadrivalent formation, linkage, nonallelic interaction and experimental design were considered in regard to the interpretation of results based on the mathematical model. The estimates of the minimum number of effective genes differentiating the two parents for mature height ranged from 0·29 in the field to 1·32 in the greenhouse. Corresponding estimates of the minimum number of genes conditioning the expression of yield were respectively 8·28 and 11·72.

576 Bingefors, S. & Panella, S.
Changes in adaptation in a Swedish and an Italian lucerne variety when grown for seed without isolation.
Euphytica, Wageningen 1960 : **9** : 74–80.

Seed of two varieties, the Swedish Tuna and the Italian Nostrale [Local], multiplied in Italy in isolated stands and in the vicinity of each other, was tested at Uppsala and Perugia. At Perugia, pure Nostrale was superior to pure Tuna in yield of green matter, while at Uppsala the reverse was true, Nostrale being susceptible to winter injury. The material which had been exposed to intercrossing was intermediate between the two pure varieties, intercrossed Tuna being rather better than intercrossed Nostrale at Uppsala and rather worse at Perugia. The need for precautions against crossing in seed production is stressed.

577 Hanson, C. H.
Registration of varieties and strains of alfalfa, V.
Agron. J. 1960 : **52** : 405–06.

Descriptions are given of the synthetics Moapa [cf. XXVIII, 1769], New Mexico 11–1 [cf. XXVI, 3419] and Zia [cf. XX, 203], which have been registered under cooperative agreement between the US Department of Agriculture and American Society of Agronomy.

578 Carnahan, H. L. *et al.*
General vs. specific combining ability in alfalfa for seedling vigor and fall growth habit in the year of establishment.
Agron. J. 1960 : **52** : 511–16.

"Seedling vigor and fall growth habit of the 91 diallel crosses among 14 alfalfa clones were scored in 3 and 4 states, respectively. Estimated variance components for general (by far the largest component) and specific combining ability and the interaction of these with locations were all highly significant for both characters. Clones differed in their contributions to both additive and non-additive genetic variances. The two characters were highly correlated (range + 0·82 to 0·93), and interlocation correlations for each character were likewise high."
[Authors' summary].

579 Ohlendorf, H.
Untersuchungen über den Samenansatz bei *Medicago falcata* und Artbastarden *M. falcata* x *M. sativa*. (**Investigations on seed set in *M. falcata* and interspecific hybrids of *M. falcata* x *M. sativa***).
Z. Pflanzenz. 1960 : **43** : 329–76.

Investigations were made on the progenies of wild forms collected on the Swedish islands of Öland and Gotland, some of which seemed to be pure *M. falcata* and others hybrids with *M. sativa*. The number of ovules per carpel varied in both from 8·50 to 11·18, the mean being 9·45 in *M. falcata* and 9·68 in the hybrids.

Great variations were found in the number of seeds set on selfing, family 39 of *M. falcata* having consistently high sets, a characteristic noted also in the mother plant from which it originated. No difference in frequency of *M. falcata* and hybrid plants was observed in the groups with high seed set but in those with low sets the *M. falcata* plants were more frequent. Plants that had been selfed were cross pollinated 14 days later, others being selfed again at the same time; the ratio of seed set by selfing and crossing was 1 : 5·0 in the *M. falcata* plants and 1 : 3·76 in the hybrids. There was a correlation of $r = 0{\cdot}63$ between set on selfing and crossing in the *M. falcata* plants and $r = 0{\cdot}89$ in the hybrids, showing the constitution of the mother plant to be an important factor in determining seed set. Both among the hybrids and the pure species certain plants with relatively high self fertility, setting up to 2·500 seeds per flower, were found. Differences in set between reciprocal crosses were more evident under conditions most favourable to seed set. Significantly better sets were obtained in pollinations between unrelated plants than from related plants. Marked differences were noted between plants within a family in the amount of seed set by open pollination, though the means for the families did not differ widely. Under open pollination the hybrid plants had slightly lower sets than those of *M. falcata*; in 1953 the set of seed per flower was 0·232 in the hybrids and 0·458 in *M. falcata*, the corresponding figures for 1954 being 0·103 and 0·129 respectively. Open pollination gave rise to slightly more seeds per pod than artificial cross or self pollination; in selfings there was a correlation of $r = 0{\cdot}53$ between number of pods set and number of seeds per pod and in cross pollinations $r = 0{\cdot}68$.

A description is given of the embryo development after self and cross pollination. In the plants that gave high sets, 82·5% of well-developed embryos were found after cross pollination and 61·6% after selfing; the plants with low sets also produced more good embryos after crossing than selfing, the figures being in this case 60·0 and 35·7% respectively. There were differences also in the number of embryos that ceased development at later stages, these differences being apparently conditioned by the interrelationships between the maternal and paternal genotypes, as well as by environmental factors. In several of the crosses there was no difference in the number of ovules fertilized in the upper and lower portions of the carpel, whereas in others the ones towards the top were more frequently fertilized than those at the base; this difference between tip and base was observed in all the selfed plants in the group with high sets but was less marked in the group with low sets. Studies of the pollen showed that the proportion of shrunken grains was characteristic of each plant and varied little from year to year; there were also significant differences between families, and the percentage of pollen that stained with carmine was 65% in the *M. falcata* plants and 75% in the hybrids. A correlation of $r = 0{\cdot}38$ was found between percentage of good pollen and set from selfing in *M. falcata* and $r = 0{\cdot}56$ in the hybrids. In crosses of both *M. falcata* and hybrid plants there were high correlations between the pollen quality of the pollinating plant and the resulting seed set, though pollen quality is clearly not the only factor that determines the set. Germination tests showed that a certain number of the pollen grains that stained nevertheless failed to germinate, the proportion varying from 13 to 38·85%, with a mean of 24%. Various meiotic irregularities, such as lagging and the presence of univalents and fragments, were detected in several of the plants examined, all of which had $2n = 32$, and there was a positive correlation between the degree of irregularity and the percentage of pollen sterility, though cases were found where plants differing in sterility had the same degree of meiotic irregularity.

No excessive growth of the integuments at the expense of the embryo was observed in any of the plants examined and embryo degeneration seemed to be conditioned from within and possibly also by underdevelopment of the endosperm.

580 Buller, R. E. & de la Cruz, P. S.
Tanverde: nueva variedad de alfalfa para la Mesa Central. (**Tanverde, a new lucerne variety for the Mesa Central**).
Agric. téc. Méx. 1959 : No. 8 : 2–3.

Tanverde, developed from the local variety Tanhuato, is widely adapted, having proved to be the most productive of eight varieties in the Bajío, the Valley of Mexico and the Valley of Toluca. Its winter production has been exceptionally good and it recovers well after cutting. It is somewhat susceptible to downy mildew and leaf spot during the rainy season.

581 Hanson, C. H., Garrison, C. S. & Graumann, H. O.
Alfalfa varieties in the United States.
Agric. Handb. US Dep. Agric. 1960 : No. 177 : Pp. 30.

An outline of breeding improved varieties and of seed-certification organization and requirements is followed by information on the principal varieties in the USA and a glossary of terms commonly associated with lucerne cultivars.

582 Childers, W. R. & McLennan, H. A.
Inheritance studies of a completely male sterile character in *Medicago sativa* L.
Canad. J. Genet. Cyt. 1960 : **2** : 57–65.

Investigations on the ♂ sterility found in plant 20DRC are reported in detail [cf. XXIX, 959]. As previously stated, the character depends upon three recessive genes, *ms*3, *ms*4 and *ms*5. These are inherited in a disomic manner. The sterility is associated with atypical tapetal behaviour at a stage after the microspores are released from the tetrads. Cytoplasmic factors are not involved. Female fertility is unaffected. This type of ♂ sterility has potential value for the production of hybrid lucerne. It is also of value in testing for pollen variability or as a top-cross parent in evaluating combining ability.

583 Zaleski, A. & Dent, J. W.
Leafiness, chemical composition and yield of some lucerne varieties.
J. Brit. Grassl. Soc. 1960 : **15** : 21–27.

In further trials [cf. XXV, 333] it has been shown that early varieties have a higher leaf : stem ratio than mid-season and late types. They also contain a higher percentage of protein and a lower crude fibre content. The heaviest-yielding varieties in this trial were Eynsford, Chartrainvilliers and du Puits while the lowest were Provence and Grimm.

584 HEYN, C. C.
The genus *Medicago* L. in Linnaeus's Species Plantarum.
Bull. Res. Counc. Israel 1959 : **7D** : 157–74.

The Linnaean species and varieties of *Medicago* are typified. It is shown that the type species of the genus is *M. radiata* and not *M. sativa* as generally accepted. Since *M. radiata* differs from all other *Medicago* species in important pod and seed characters, the author suggests that it should be separated from the genus although the generic name *Medicago* should be conserved to avoid confusion.

585 HEINRICHS, D. H. & MORLY, F. H. W.
Inheritance of resistance to winter injury and its correlation with creeping rootedness in alfalfa.
Canad. J. Pl. Sci. 1960 : **40** : 487–89.

An analysis of data on winter hardiness and creeping rootedness in a population of lucerne plants, derived from *Medicago falcata* x *M. media*, revealed a positive genotypic correlation of 0·38 between the two characters. The data also indicated that most of the genotypic variation in the case of winter hardiness was nonadditive; thus this character cannot be expected to be responsive to mass selection. However, the additivity of genotypic variation for creeping rootedness, and the existence of the correlation, suggest that selection for increased creeping rootedness will be accompanied by increased hardiness.

586 PALMER, T. P.
Winter growth of lucerne (*Medicago sativa*). I. Variety performance in New Zealand.
NZ J. Agric. 1959 : **2** : 1195–1202.

The varieties in decreasing order of winter growth are: African; Hunter River and Provence; Marlborough and du Puits; New Zealand Certified (strain B) and Parachimar; and Rhizoma. The finding that varieties from tropical or Mediterranean climates are the most winter-active in New Zealand is in agreement with Morley's results at Canberra, Australia [cf. XXVII, 3088], but in contrast with Zaleski's findings at Cambridge, England [cf. XXIV, 2094]. Differences in day length are suggested as a possible explanation.

587 SHERWOOD, R. T., WELLS, J. C. & SASSER, J. N.
New varieties fighting nematodes.
Res. & Fmg. 1959 : **18** : p. 13.

The lucerne variety Lahontan which is resistant to *Ditylenchus dipsaci* was crossed with du Puits, and the progeny back crossed twice to the latter. The back-cross material has the vigour of du Puits but a lower disease rating.

588 GOPLEN, B. P. & STANFORD, E. H.
Autotetraploidy and linkage in alfalfa—a study of resistance to two species of root-knot nematodes.
Agron. J. 1960 : **52** : 337–42.

Resistance to *Meloidogyne hapla* in selection M–9 of Vernal depended upon a single dominant gene (Rk_1) segregating tetrasomically, while resistance to *M. javanica javanica* was conditioned by another single dominant tetrasomic gene (Rk_2), the two genes being closely linked. One other selection (M–7) of Vernal showed resistance to both species and a third selection (M–4) of this variety and one (M–8) from the Hilmar strain of California Common resistance only to *M. hapla*. Genetic data are less conclusive for these clones but inheritance of resistance appears to be fairly simple.

589 KLEMENT, W. J. & RANDOLPH, N. M.
The evaluation of resistance of seedling alfalfa varieties and strains to the spotted alfalfa aphid, *Therioaphis maculata*.
J. econ. Ent. 1960 : **53** : 667–69.

Of the varieties tested, Cody, Lahontan and Moapa showed the highest degree of resistance, Zia was slightly less resistant, and African, Atlantic, Epley, Orestan, Original C40 and Ranger were only moderately resistant.

590 TRIMBLE, J. P. & HOVIN, A. W.
Interspecific hybridization of certain *Trifolium* species.
Agron. J. 1960 : **52** : p. 485.

With *T. repens* used as the female parent, a triploid ($2n = 24$) hybrid between that species and *T. nigrescens* was obtained. Its morphological characteristics were intermediate between those of the two parent species. The hybrid proved to be entirely sterile and no seed resulted from selfing approximately 1000 florets or from reciprocal back-crosses to either parent species.

591 Focke, R.

Einige genetische und evolutionistische Besonderheiten polyploider Formen und deren Bedeutung für die Pflanzenzüchtung. **(Some characteristics of polyploid forms from a genetic and evolutionary standpoint and their importance for plant breeding).**

Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1960 : No. 42 : Pp. 120.

The first part of the monograph is devoted to a discussion of the genetic relationships in autopolyploid plants. Various factors that may complicate the segregation ratios, such as chromatid segregation, tetrasomic inheritance, polysomy and polyploidy are considered on the basis of data published in the literature, it being suggested that such deviations may have led some natural autopolyploids to be classed as diploids or alloploids. Calculations of the frequencies of the different genotypes show that transgressive inheritance for any given genotype is less frequent in polyploids than in diploids. The loss in yield from inbreeding is also less. Chromosome breaks have been found to be more frequent in polyploids and this may be of advantage in breaking undesirable linkages, say between genes favourable and unfavourable to yield. Comparisons were made between an F_1 hybrid between two mutants of *Antirrhinum majus* and the tetraploid produced from it by colchicine treatment. The $4n$ population, containing a greater proportion of heterozygous plants, was superior in yield as expressed by leaf length. If a favourable mutant appears in the population, it will be selected more slowly in a tetraploid on account of the greater heterozygosis; conversely, a deleterious mutant will remain in the population longer in a tetraploid population. The calculation of gene frequencies according to the Hardy-Weinberg law shows that the degree of relationship is greater in the progeny from inbreeding tetraploids of a given genic constitution than from the corresponding diploids. The proportion of sterile combinations in the F_1 from a cross differing in three or four S genes is shown to be greater in tetraploids [cf. XXV, 3140]. Reference is made to the effect of polyploidy on heterostyly [cf. XXIII, 2605], male sterility [cf. XXIII, 2867] and sex ratios; the author's own results have shown that in tetraploid spinach, as in *Melandrium album*, XXXY individuals are pure males and give normal 1 : 1 sex ratios in their progenies.

The second part deals with the differences between natural and artificial polyploids. The main literature on the characteristics of polyploids is reviewed and some data are presented from the author's own experiments, which confirm the inferiority of freshly produced autotetraploids of *Antirrhinum* in respect of yield of capsules and seed. It is pointed out that certain polyploid species occurring in nature, such as *Veronica agrestis* and *V. opaca* ($2n = 14$), have no apparent advantage over the diploid species, whereas *V. tournefortii*, also with $2n = 14$, has very marked colonizing abilities; this is related to the greater possibilities for recombination of multiple alleles existing in the polyploids. The greater range of recombination in the polyploids tends to make their evolution slower; when they meet a set of new or extreme conditions, however, their evolutionary potentialities may be realized. Most artificial polyploids have originated from a relatively small number of individuals, often a dozen or two; it is highly improbable that the whole range of genetic variation will be represented in so small a sample; it will therefore take some considerable time before artificial polyploids can equal natural ones in adaptability and yielding abilities. Work of Rasmusson [XXIII, 2106] and others is cited to show that this is brought about by natural selection about as quickly as by artificial selection.

Part 3 deals with the application of the above principles to breeding tetraploid clover. The breeder is recommended to start with as wide a range of varieties, of as varied origin as possible, subject them all to colchicine treatment and allow the polyploids to grow together, without any artificial selection, for several generations. The seed from the first generation plants is collected separately, part of it being examined for chromosome constitution and part used for sowing in the following generation, again as a mixed population, to which polyploids from other breeders may also be added. Selection is started only after "several generations" have been reproduced as populations.

The degree of depression from selfing a tetraploid has been found to vary according to the parental material, being very low in certain selfed progenies from Lembke's red clover and very high in those from a Portuguese red clover. Lines of the former type, showing little inbreeding depression, should be mixed with the others to improve the fertility of the strain. Since inbreeding can be successfully avoided in diploids by mixing four F_1 lines this number is expected to be more than adequate for the production of a tetraploid strain. Various methods of producing such a strain with the maximum yielding capacity are considered. One of these consists in selecting the most vigorous plants from a population and growing the progeny of 3–5 of them together in rows; this process is repeated in a number of successive years, the inferior progenies being discarded. The families are combined in a different order each year, so that selection is possible without reducing the heterozygosity.

592 LOTERO C., J. & CROWDER, L. V.
La producción de gramíneas y leguminosas en Colombia. II. Estudio de variedades de trébol rojo. **(The production of grasses and legumes in Colombia. II. A study of red clover varieties).**
Agricultura trop. 1960 : **16** : 392–400.

The most suitable varieties of red clover for Colombian conditions are those originating from areas of latitude 38°–48° N., according to a series of trials at the National Centre for Agricultural Research at Tibaitatá.

Varieties from more southerly latitudes showed poor resistance to drought. Their yields were fairly high, particularly in the first two cuts but the forage obtained was of poor quality because of the high proportion of flowering stems present. Poorest results were obtained with varieties from 50° N. areas.

A Chilean selection, referred to as Cowgrass, gave excellent results in 1958 trials, confirming favourable reports from other localities.

593 MCLENNAN, H. A., GREENSHIELDS, J. E. R. & MACVICAR, R. M.
A genetic analysis of population shifts in pedigree generations of Lasalle red clover.
Canad. J. Pl. Sci. 1960 : **40** : 509–15.

A study of population shifts, as indicated by changes in the distribution of leaf markings, has been made in pedigree generations of Lasalle, a variety constituted by blending equal parts of Ottawa and Dollard seed at the foundation seed level. A preliminary investigation had revealed that 96·4% of Ottawa plants carry a white leaf mark, while only 12·4% of Dollard plants are similarly marked. The results indicated that there was a significant shift towards the Dollard component when Lasalle was grown in western Canada, while in eastern Canada the components remained in equilibrium or drifted slightly towards the Ottawa type. The reasons for such population shifts, and their significance, are discussed.

594 POVILAITIS, B. & BOYES, J. W.
Ovule development in diploid red clover.
Canad. J. Bot. 1960 : **38** : 507–39.

"In red clover only one ovule of the two in each ovary regularly develops into a seed. Results of two experiments designed to reveal the fate of the ovules initially present provide a basis for comparing some features of ovule development in high- and low-seed-yielding plants. High-yielding plants produced embryo sacs in over 70% of ovules whereas low-yielding ones produced them in about 40%. The ability to produce embryo sacs seems to be genetically determined but strongly influenced by environment and occasionally by meiotic irregularities. Development started in about 85% of the fertile ovules in the high-yielding plants but in only about 60% of them in low-yielding plants. Apparently there was slow or limited growth of pollen tubes in the latter plants. Nearly 55% of the ovules developing just after fertilization matured into seeds in the high-yielding plants but only about 25% in the low ones. The higher frequency of ovule collapse in low-yielding plants seems to be a consequence of the delayed fertilization followed by retarded growth of the embryos and endosperms.

"Although a few more ovules did start to develop in out-crosses than in sib-crosses, the more vigorous growth of the endosperm seems quite important in accounting for the superior seed yields in the out-crosses. Also a few more ovules started to develop when the pollen came from a high-yielding plant instead of a low-yielding one and this initial advantage seems to lead to improved seed production.

"It is suggested that low-seed-producing plants may have certain genes that act like weak self-incompatibility alleles by inhibiting pollen tube growth, or, that their genetic constitutions are such that they cannot produce enough embryo sacs and/or support the growth of pollen tubes and ovules." [Cf. XXX, 486].

[Authors' summary.

595 SCHWEIGER, W.
Die Bestäubung tetraploiden Rotklees durch Bienen unter Isolierkästen. **(The pollination of tetraploid red clover by bees under isolation cages).**
Züchter 1960 : **30** : 43–44.

Pollination by *Apis* sp. in isolation cages was found to be a satisfactory method of effecting controlled crosses; the seed set was much lower when *Bombus* was used as pollinator.

596 Stroube, W. H., Fergus, E. N. & Taylor, N. L.
Red clover with two seeds per floret may be developed.
Crops & Soils 1960 : **12** : No. 9 : p. 23.

Data are reported which indicate that the percentage of two-seeded red clover florets can be increased by selection. The authors describe an investigation in Kentucky in which the incidence of such florets increased sevenfold from one generation to the next.

597 Badoux, S., Corbaz, R., Pelet, F. & Savary, A.
La "fatigue" du trèfle. **(Clover sickness).**
Rev. rom. Agric. 1960 : **16** : 69–73.

Selection of red clover plants which resist infection by *Sclerotinia trifoliorum* and subsequent hybridization of these individuals is currently under way in Lausanne, Switzerland.

598 Vestad, R.
The effect of induced autotetraploidy on resistance to clover rot (*Sclerotinia trifoliorum* Erikss.) in red clover.
Euphytica, Wageningen 1960 : **9** : 35–38.

In Norwegian studies of corresponding diploid and tetraploid families obtained from crosses between chimeral plants, the tetraploids proved to be more resistant to *S. trifoliorum* than the diploids. A significant interaction between family pairs and level of ploidy indicated that the effect of induced autotetraploidy on resistance to clover rot may vary according to genotype.

599 Crowder, L. V.
La producción de gramíneas y leguminosas en Colombia. I. Estudio de variedades de trébol blanco. **(The production of grasses and legumes in Colombia. I. A study of white clover varieties).**
Agricultura trop. 1960 : **16** : 383–92.

Information is presented on trials to determine the type of white clover most suitable for the cool climate of Colombia. Several varieties belonging to four groups of white clover, Dutch, intermediate, Ladino and polyploid, were compared. The intermediate varieties flowered most abundantly and on average gave the highest yields at the first harvest; Louisiana Synthetic 1, the highest-yielding variety in the entire trial, also showed very rapid recovery from drought. High susceptibility to disease was the most unfavourable characteristic of the intermediate varieties.

By the second harvest, the Ladino and polyploid types were equal in yield to the intermediates. The Ladino group showed high disease resistance and drought recovery, although their flowering capacity was low. This disadvantage may be expected to disappear after several generations of selection in Colombia. The over-all results indicated that Ladino is the most suitable type for Colombian conditions.

600 Hawkins, R. P.
Investigations on local strains (varieties) of herbage plants. IV. White clover.
J. Brit. Grassl. Soc. 1960 : **15** : 28–33.

Following usage recommended by the International Union of Biological Sciences, the term "variety" is used where "strain" was used in earlier papers of this series [cf. XXIV, 1181]. The characteristics of the indigenous English white clovers, Kent wild, Kersey and English Giant (Dutch) are discussed and data illustrating variations in leaf size and stolon thickness are presented. Some of the uncertified wild white clovers on the market were found to be extremely variable. Certain stocks of Kersey white clover have appeared with smaller leaves and thinner stolons than the normal type. Evidence is presented to indicate that these changes are a result of natural intercrossing with wild white clover. The need to preserve the original characters found in local varieties is emphasized.

601 Beatty, D. W.
Effect of photoperiod and temperature on flowering of white clover (*Trifolium repens*).
Diss. Abstr. 1960 : **20** : LC Card Mic 60–567 : p. 3460. (Abst.).

In nine Ladino clovers and three wild ecotypes from Arizona, Michigan and Minnesota, wide variation was found in response to day length, temperature and different combinations of the two factors. Temperature treatments modified the photoperiodic requirements of the clones, causing long-day plants to flower under short-day conditions and *vice versa*. Flowering of the wild ecotypes was markedly increased by exposure to cool autumn conditions; the Minnesota clone appeared to have an obligatory requirement for cold-temperature induction.

602 Vez, A.
Examen de la palatabilité de différentes variétés de trèfle blanc. **(An examination of the palatability of different varieties of white clover).**
Landw. Jb. Schweiz 1959 : **8** : 735–41.

No significant differences in palatability were observed in very young pastures but when the pastures were six weeks old the cows showed marked preference for the varieties such as 5100 with the densest foliage and highest water content. It is thought that fibre content is not important in determining palatability.

603 Bendixen, L. E., Stanford, E. H. & Peterson, M. L.
The physiological nature of gene-controlled growth form in *Trifolium fragiferum* L. I. Inheritance of growth form.
Agron. J. 1960 : **52** : 447–49.

An investigation of seven erect-growing plants occurring in a population of 1400 Salina plants has shown that erect versus stoloniferous growth is determined by a single gene, with stoloniferous dominant. Partial or complete reversion to the dominant character occurred among the original plants and the progeny of both erect x erect and erect x stoloniferous crosses. Instability at the erect locus appeared to be genetically controlled.

604 Hollowell, E. A.
Registration of varieties and strains of crimson clover, II.
Agron. J. 1960 : **52** : p. 407.

Chief [cf. XXIX, 1664], recently registered by the US Department of Agriculture in cooperation with the American Society of Agronomy, is described.

605 Oppenheimer, H. R.
The origin of the Egyptian clover with critical revision of some closely related species.
Bull. Res. Counc. Israel 1959 : **7D** : 202–21.

Detailed botanical descriptions are given of *Trifolium carmeli* and *T. vavilovi.* From a comparison of *T. aperta* and the Egyptian clover *T. alexandrinum* it is concluded that the former should be grouped with *T. carmeli* and *T. vavilovi. T. berytheum* is considered to be the species most closely related to *T. alexandrinum* [cf. XXX, 3621] and a botanical description is given under *T. alexandrinum* var. *berytheum.*

606 Hollowell, E. A.
Registration of varieties and strains of vetch. (*Vicia* spp.).
Agron. J. 1960 : **52** : p. 407.

Vicia dasycarpa 'Lana', selected from a Turkish introduction, has been registered by the US Department of Agriculture in cooperation with the American Society of Agronomy. Maturing earlier than Auburn, it has outstanding reseeding capacity and is adapted to range conditions in California, with an average of 10 in. of rainfall per annum or more at altitudes of 0–4000 ft.

607 Kumar, S.
Chromosome numbers in some species of *Vicia.*
Curr. Sci. 1960 : **29** : p. 229.

V. onobrychoides and *V. sepium* had $2n = 12$. *V. faba* had $2n = 12$, and *V. monantha, V. narbonensis, V. ervilia* and *V. grandiflora* $2n = 14$.

608 Golicyn, S. V. & Danilov, V. J.
(*Onobrychis radiata* M.B., a new Caucasian plant in the flora of the eastern Ukraine).
Bot. Ž. (Bot. J.), Moskva 1960 : **45** : 727–30. [Russian].

Descriptions are given of specimens of *O. radiata* found in the north-eastern part of the Lugan province of the Ukraine, almost 1000 km. distant from the point of Transcaucasia where it had previously been recorded. The species is considered distinct from *O. vassiltschenkoi*, with which it has sometimes been identified.

609 Gorz, H. J. & Haskins, F. A.
Genetic blocks in the synthesis of coumarin in *Melilotus alba.*
J. Hered. 1960 : **51** : 74–76.

From tests on 25 plants each of the homozygous genotypes *CuCuBB*, *CuCubb*, *cucuBB* and *cucubb*, to determine the influence of the two gene pairs on the amount and form of coumarin produced, it is concluded that the effect of *cu* in blocking coumarin synthesis is partial rather than complete, while that of *b* is virtually complete. The following relationship is postulated: coumarin precursors $\xrightarrow{cu}$ bound coumarin $\xrightarrow{b}$ free coumarin.

610 ZACHOW, F.
Untersuchungen über Faktoren an spontanen und röntgeninduzierten Behaarungsmutanten von *Lupinus luteus*, die die Saatgutqualität beeinflussen, und ihre Bedeutung für die züchterische Weiterentwicklung der gelben Süsslupine. (**Investigations on spontaneous and X-ray-induced mutations for hairiness in *L. luteus* which influence seed quality, and their importance for the further development of the sweet yellow lupin by breeding**).
Züchter 1960 : **30** : 101–17.

Comparisons were made between 7 forms with normal pubescent pods and 6 mutants with reduced pubescence, some of them distinguished by shorter hairs, some by hairs of medium length and some by shedding hairs.

Dry-matter content was determined in the seeds from pods that had, over a period of 1-6 days, been immersed in water at hourly intervals during the day and then allowed to dry. Differences were detected between the varieties in the rate of loss of dry matter and although there was not a complete correlation with hairiness, the forms with the best dry-matter content after treatment were the strains with medium-long, shedding and short, shedding hairs respectively, all of which were better even than two lines of *L. angustifolius*, in which species the pods are naturally less hairy than those of *L. luteus*.

The rate of water loss was determined in pods that had been immersed for 15 sec. in water and allowed to drain for 15 sec. The mutants with reduced pubescence and *L. angustifolius* had lost as much water after 15 sec. as the hairy forms lost after 1 hr.; the amount of water left on the pods after 1 hr. was least in *L. angustifolius* and in the mutants HE 55 and 604, both with medium-long hairs, and the mutant 604 with short, shedding hairs. The hairy forms took 12–14 hr. to reach their original weight by evaporation, the mutants required 8 hr. and *L. angustifolius* only 4–6 hr.

All but one of the above forms were tested also in the open, each being grown in a plot of 50 m²., half the plants of which were cut and stacked when ripe, the other half being allowed to stand. In the first few weeks after maturity the dry-matter content fell more in the short-haired mutants and in *L. angustifolius* than in the hairy forms, evidently owing to the action of the dew. Somewhat later, after a period of frequent rainfall, the least loss of dry matter was observed in the two mutants of 604 with medium-long and shedding hairs respectively, but the short-haired mutants again had the lowest dry-matter content. The germination percentage also suffered least in the two mutants with medium-long and shedding hairs and in a hybrid referred to as Untersaatlupine [Undercropping lupin], from an Iberian wild with various Gülzow lines. Water absorption by the seeds proved to be lowest in the mutant 604 with medium-long hairs and, particularly, in the Untersaatlupine. The rate at which water penetrated the seed coat was also shown to be higher in the mutants, except 604 with shedding hairs, than in the normal forms. The rates of water absorption and of penetration are thought to be responsible for the disappointing behaviour of the short-haired mutants in the field. Among the mutants with medium-long hair, one, 604, was lower and the other, HE 55, was higher in rate of water absorption. It is therefore believed that it should be possible by breeding to produce forms combining short hairs with low water absorption. No correlation has been found between water-absorbing rate and late germination or maturity.

Trials of yield showed that over a period of 2–4 years the mutants with reduced hairiness produced less seed and usually less green matter than the normal hairy variety Gülzower Süsse Gelbe [Gülzow Sweet Yellow]; the line HERW, a hybrid of HE x a spontaneous short-haired mutant, had a mean seed yield of 23·35 c. per ha. and a yield of green matter of 279·7 c. compared with 30·23 c. and 348·2c. respectively for Gülzower Süsse Gelbe, the difference in seed yield being statistically significant. In this mutant both the length and breadth of the leaflets are less than in the normal form and in crosses between the two no breakage of the linkage between short hairs and small leaflets occurred; the same relationships were found in the strain with short shedding hairs, which derives from the same short-haired mutant. Other mutants however, like HE 55 with medium-long hairs and 604 with shedding hairs, showed no such correlation and had leaves of normal size; the latter mutant also proved equal to the normal form in yield of green matter and since it is one of those with a low rate of water absorption it is thought to be a promising parent for crossing with the Untersaatlupine and others in breeding for forms with improved seed quality.

611 **Blanco, new blue forage lupine.**
Crops & Soils 1959 : **12** : No. 3 : p. 20.

Blanco, a nonbitter blue lupin developed at the

Georgia Coastal Plain Experiment Station, Tifton, Ga., is well adapted to late-winter grazing in southern Georgia and northern Florida. It has white flowers and seeds and green stems and leaves with no purple pigment. Blanco is equal to Borre blue lupin in forage production, palatability, sweetness, softness of seed and reaction to frost, diseases and insects.

612 Kempanna, C.
Chromosome numbers of some *Crotalaria* species.
Sci. & Cult. 1960 : **25** : p. 644.

A $2n$ number of 16 is reported for *C. brownei*, *C. lanata*, *C. intermedia* and *C. goreensis*.

613 Poostchi, I.
Agronomic, genetic and cytological investigations on vigor of establishment, growth form and other morphological characters in birdsfoot trefoil (*Lotus corniculatus* L.).
Diss. Abstr. 1960 : **20** : LC Card Mic 60–602 : p. 3463. (Abst.).

Plants of *L. corniculatus* 'Viking', 'Empire' and 'Arvensis' were crossed in all possible combinations and it was found that Viking-Arvensis F_1 plants showed greater stem length and higher dry-matter yields than Empire-Arvensis crosses. F_1 and back-cross generations had greater stem length and higher dry-matter content than F_2 generations. Rate of recovery after harvest was greater in Viking-Arvensis than in Empire-Arvensis hybrids. Many genes appear to be involved in stem length and dry-matter yields. Vigour of establishment in Viking was transmitted to progenies from crosses with Arvensis and Empire in their F_1, F_2 and back-cross generations. The early-flowering habit of Viking and Arvensis in Viking-Empire and Arvensis-Empire crosses was found to be dominant over the late-flowering habit of Empire. Growth habit, flower size, leaf size and brown keel-tip colour are conditioned by multiple factors and leaf colour and flower colour by a single factor.

In meiosis the chromosomes paired regularly as bivalents; quadrivalents were observed infrequently. Cytological examination of parents and their F_1 and F_2 progenies at prophase II revealed 12 distinct chromosomes. All of 40 plants investigated showed at least one laggard chromosome per cell at some stage of meiosis. "Disregarding the major contributions made by two plants to laggard formation in parental and F_1 self-sterile classes, the number of cells showing laggards was highest for the F_2 class." The prevalence of functional microspores was greatest in the parent class and smallest in the F_2. The number of seeds per inflorescence and number of pods per inflorescence were lowest in selfed F_1 plants and highest in sibbed F_1 plants, with back-cross plants intermediate. It was noted that high temperature and low humidity encouraged selfing.

614 Gondola, I.
Előzetes közlemény a szarvaskerep botanikai vizsgálatáról. (**Preliminary communication on a botanical study of birdsfoot trefoil**).
Mosonmagyar. Mezőgazdaság. Akad. Közl. Debrecen 1959 : **1** : 145–71 : from Hungar. agric. Rev. 1960 : **9** : No. **2** : 13–14. (Abst.).

Lotus corniculatus and the botanical variety *hirsutus* occur together on arid sites, but only the former grows in less dry areas. The subspecies *tenuifolius* has a higher salt tolerance and is frequent on alkali and wet soils. It is thought the differences in morphology and ecological requirements may be useful in breeding.

615 Peacock, H. A. & Wilsie, C. P.
Selection for vegetative vigor and seed setting in birdsfoot trefoil (*Lotus corniculatus* L.).
Agron. J. 1960 : **52** : 321–24.

Thirteen clones provided the parental material for a study conducted at the Iowa Agricultural Experiment Station. Four (group I) were selected from European introductions on the basis of upright growth habit, winter hardiness, disease resistance and recovery after cutting. The other nine clones were selected from the experimental first-cycle synthetic Acc. 2270 of New York Empire, produced by combining equal quantities of seed from 45 diallel single crosses of 10 clones. The nine clones were semiprostrate to prostrate and were selected primarily for vigour, winter survival and disease resistance. Three groups (II, III and IV), each consisting of four clones, were made up from the nine clones. Data were obtained on the forage and seed yield of diallel single crosses within each group and open-pollinated progenies of 11 of the parental clones. The performance of the latter type of progeny provided a good indication of diallel-cross forage and seed yield. No apparent gain in either character was made in the first (Acc.

2270) or second cycle (II–IV) of selection Empire; it is pointed out that this is not surprising in view of the fact that in both cycles selection had not been primarily for forage or seed yield. Of the four groups, I gave the lowest forage and seed yield. Clone C–43 ranked highest and B–3 second best for general combining ability for forage yield, while C–43 ranked best and B–69 second best for general combining ability for seed production. F_1 C–43 x B–3 was higher in forage yield and F_1 C–43 x B–69 higher in seed yield than other F_1s. Correlations and path coefficients indicated that genetic effects were more important than environmental in contributing to the variability of the diallel crosses and open-pollinated progenies in forage and seed yield and growth habit. Some F_1 individuals in the second cycle of selection of Empire were outstanding in forage yield and others superior in seed production, the possibility of improvement in either character in a third cycle of selection thus being indicated. Finally, attention is drawn to the significance of natural selection in the improvement of the species in Iowa. Data on the forage yield of New York Empire, Iowa Empire (two seed generations in Iowa) and Acc. 2270 revealed a marked superiority of Iowa Empire.

616 Ledingham, G. F.
Chromosome numbers in *Astragalus* and *Oxytropis*.
Canad. J. Genet. Cyt. 1960 : **2** : 119–28.

Chromosome counts are reported for 84 species of *Astragalus* and *Oxytropis* [cf. XXX, 14]. Compared with previous reports, the counts confirm 26 and differ from 5; those for the remaining 53 species are recorded for the first time. The characteristic New World species of *Astragalus* have $n = 11$, 12 and 13, while Old World species of *Astragalus* and *Oxytropis* have $n = 8$, 16, 24 and 32. Some $n = 8$ species of *Astragalus* are found in North America, but these and the *Oxytropis* species in North America have apparently migrated from the Old World into the New, where their distribution is still mainly confined to the northwestern part of North America. It is considered that chromosome number in the two genera is a reliable indication of interspecific relationships. It is therefore suggested that the characteristic New World species of *Astragalus* should be placed in a new genus, to separate them from Old World 8-chromosome species of *Astragalus* and *Oxytropis*.

ROOTS AND TUBERS

617 Savitsky, H.
Meiosis in an F_1 hybrid between a Turkish wild beet (*Beta vulgaris* ssp. *maritima*) and *Beta procumbens*.
J. Amer. Soc. Sug. Beet Tech. 1960 : **11** : 49–67.

A detailed study of meiosis in the hybrid of Turkish wild beet x *B. procumbens* indicated that the moderate fertility of this hybrid is due to the formation of restitution nuclei. The study revealed a new way whereby such restitution nuclei may be formed, namely by the regular division in an asynaptic pollen mother cell of all the univalents during the first meiotic division. Progeny was produced in the F_1 hybrids only after the number of their chromosomes had been increased by means of a change to a higher ploidy level. Observations on the progeny of the first back-cross generation, F_1 x $2n$ *B. vulgaris*, revealed that in the case of the F_1 only diploid gametes containing a complete, or virtually complete, haploid set of the chromosomes from both parents were viable. It is suggested that to overcome the barrier of sterility in interspecific hybrids between *B. vulgaris* and species of the section *Patellares*, it may be desirable to obtain hybrids on a higher ploidy level.

618 Wöhlert, W. & Senff, G.
Auslese von Futterrüben auf Eiweissgehalt mit Hilfe der "Blauzahlmethode". **(The selection of mangels for protein content with the help of the "blue number method").**
Züchter 1960 : **30** : 17–22.

A simple procedure for determining protein content based on the blue number method of Staněk and Pavlas is described. Ten ml. of mangel juice are mixed with 80 ml. of a solution of 0·3 kg. lead acetate + 0·1 kg. lead oxide in 1 l. water and filtered. To 50 ml. of the filtrate are added 5 ml. of the reagent (10 g. copper nitrate + 250 g. sodium acetate in 1 l. water). The resulting blue colour is compared with that of standard solutions which may contain known quantities of aminoacids and a copper salt or they may be made up by diluting a basic solution of 66 g. copper sulphate and 3 g. cobalt ammonium sulphate in 1 l. of ½% sulphuric acid. The nitrogen estimated in this way is positively correlated with the protein nitrogen. Some data are provided on the contents of nitrogen, sugar and dry matter found in nine varieties in four years. External factors affecting these estimates are mentioned.

619 Fitzgerald, P. H.
The X-ray sensitivity of *Brassica rapa* L. seeds.
NZ J. Agric. 1959 : **2** : 1257–61.

Using *B. rapa* 'Imperial Green Globe', it was established that the dose required to kill 50% of the population was about 75,000 r. while the critical dose for the purpose of mutation breeding was about 80,000 r.

620 Estudios sobre tubérculos alimenticios nativos de la región andina. (**Studies on native edible tubers of the Andes region**).
Com. Turrialba 1958 : No. 63 : Pp. 49. (Mimeographed).

Details are given of the origin, variability and nutritional significance of *Oxalis tuberosa*, *Ullucus tuberosus* and *Tropaeolum tuberosum*. The publication includes Spanish translations of early Russian studies on these crops by Bukasov and Razumov.

621 Plaisted, R. L.
A shorter method for evaluating the ability of selections to yield consistently over locations.
Amer. Potato J. 1960 : **37** : 166–72.

An alternative statistical method for making numerical estimates of consistency of cropping ability is proposed [cf. XXX, 522]. The results obtained are the same as with the earlier method but less computational effort is required. An analysis of results of potato-variety yield trials in New York State illustrates the technique. "The larger the contribution of a variety to the variety x location interaction, the smaller will be the estimate of the remainder interaction component of variance. Therefore in the analysis of real data with estimates of the remainder interaction component of variance ranked from high to low, the dependability of the variety will also be ranked from high to low."

622 Furunes, J.
Forsøk med tidlige potetsorter 1929–56. (**Trials of early potato varieties, 1929-56**).
Forskn. Fors. Landbr. 1960 : **11** : 421–32.

On the basis of the results of the above trials, conducted at Vågønes (67° 17′ N.), Epicure, Early Puritan, King George V and possibly Early Rose are regarded as suitable for cultivation in northern Norway.

623 Pandey, K. K.
Self-incompatibility in *Solanum megistacrolobum* Bitt.
Phyton, Vicente López 1960 : **14** : 13–19.

Within each of the families from the reciprocal crosses 2535 x 2537 and 2537 x 2535, four intrasterile interfertile groups could be distinguished; crosses between test plants of the two families showed that the same four genotypes were present in each. These results indicated that the self incompatibility is of the monogenic, multiallelic gametophytic type. The observations that induced autotetraploidy resulted in self compatibility in each of the four genotypes and that another set of six autotetraploids from a cross between two other clones included four self-compatible and two self-incompatible plants suggest that competitive interaction between alleles in the pollen grain, resulting in self compatibility, is common in this species [cf. XXVI, 3430].

624 Estrada Ramos, N.
Herencia del albinismo en especies de papa diploides y tetraploides. (**Inheritance of albinism in diploid and tetraploid potato species**).
Agricultura trop. 1960 : **16** : 348–52.

Two diploid species, *Solanum chacoense* and *S. phureja*, and two tetraploid species, *S. acaule* and *S. tuberosum*, were selfed. Some albino plants appeared, this condition being governed by a recessive, simple Mendelian factor. In both diploid species the ratio of green to albino plants was 3 : 1, showing disomic inheritance. In *S. tuberosum* the ratio was approximately 35 : 1, indicating that the species is probably an autotetraploid with random segregation at meiosis. The ratio was approximately 15 : 1 in *S. acaule*, suggesting that the species is an allotetraploid.

625 Gardé, N. M.
Mechanisms of species isolation in tuberous *Solanum*.
Agron. lusit. 1959 : **21** : 19–42.

The species studied comprised *S. kurtzianum*, *S. vernei*, *S. simplicifolium*, *S. soukupii*, *S. phureja*, *S. verrucosum*, *S. polyadenium*, *S. cardiophyllum*, *S. ehrenbergii*, *S. jamesii* and *S. pinnatisectum*. Only *S. verrucosum* was self compatible. The species of series *Tuberosa* were mutually cross compatible or semi-compatible but incompatible with the other series. *S. verrucosum* was compatible as female parent with all species except *S. polyadenium*. The species of series *Polyadenia* and *Cardiophylla* were generally incompatible with the other series except for the combinations *S. polyadenium* x *S. kurtzianum* and *S. polyadenium* x *S. simplicifolium*. The species of series *Pinnatisecta* are generally semicompatible with the other series. Many intraseries and interseries hybrids were raised and are described. The genetics of incompatibility is explained on the assumption of a series of multiple *S* alleles and a factor *R* which prevents fertilization with certain of the *S* alleles only.

626 ŚWIEŻYŃSKI, K.
Selekcja ziemniaków na cechy użytkowe. Cz. II. Zmienność krzakowa. (**Selection of potatoes for useful characters. II. Variation of the plant**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1959 : **3** : 685–715.

In studies of the clonal variation occurring among plants growing in the same field, the following observations were made. Large tubers were more elongate and had deeper eyes and more pronounced secondary growth than small tubers; they were more variable than small tubers in these characters but less so in specific gravity and intensity of flesh colour. Varieties with long tubers, deep eyes or a tendency towards secondary growth occasionally included a number of round tubers, tubers with shallow eyes and tubers showing no secondary growth, respectively; but the converse relationship did not hold in varieties with the reverse characters. Characters typical of the clone were generally more apparent in large tubers than in small. Intraclonal correlations between plants growing in the same field were low or moderate for most of the characters studied.

627 NIESCHULZ, A.
Die Verbreitung der Kartoffelsorten im Jahre 1959. (**The distribution of potato varieties in 1959**).
Kartoffelbau 1960 : **11** : 72–73.

The data presented show that Maritta is now the most widely grown variety in Federal Germany, Ackersegen being still the next and followed by Lori, Lerche [Lark], Bona and Grata.

628 RIGOT, N.
Performances de quelques variétés belges de pommes de terre. (**The performance of some Belgian potato varieties**).
Rev. Agric., Brux. 1960 : **13** : 57–64.

Further information is presented on the varieties Électre and Gari [cf. XXVI, 1410 and XXVIII, 4391]. The results are reported of yield trials carried out between 1952 and 1959 at the Research Station in Libramont, the control varieties being Bintje and Voran. Électre has given consistently high yields except under drought conditions; it has also continued to demonstrate high resistance to *Phytophthora* and to virus diseases. Gari is intermediate between Électre and the control varieties as far as resistance to these diseases is concerned. Data are given on a new variety Gaumaise, a selection from the old French variety Rosa. It possesses most of the characteristics of Rosa, high resistance to *Fusarium* and common scab, immunity to wart, and susceptibility to *Phytophthora* and to virus diseases. Gaumaise matures 15–21 days before Rosa and exceeds it in yield. The variety performs best on light, organic soils with a high nitrogen content.

629 **Five new potato varieties released.**
Agric. Res. Wash. 1960 : **9** : No. 2 : p. 13.

A brief description is given of Catoosa, Redskin, Blanco, Navajo and Erendera, varieties released in 1959 under the USDA-State National Potato Breeding Program. Catoosa is the first red-skinned potato showing some resistance to both late blight and scab. It is superior to Pontiac in culinary qualities and compares favourably in yielding ability with standard varieties of the southern United States. Redskin is resistant to scab and net necrosis caused by leaf roll. Its yields are as high or higher than the standard varieties grown in most states. The other varieties have been described elsewhere [cf. XXX, 1698, XXIX, 4030, and XXIX, 2821].

630 Description des variétés inscrites au catalogue en 1959. (**A description of varieties entered in the catalogue in 1959**).
Pomme d. Terre franç. 1960 : **23** : No. 247 : 15–17.

Delos was developed in Germany from a cross between Bona and M4.229. It is fairly late and is resistant to both wart disease and blight. The yellow tubers are large and oblong and have superficial eyes. Kenavo, a high-starch variety developed in France from Roswitha x Prymas, is late-maturing and resistant to wart and blight. The tubers, which are round and medium-sized, have slightly sunken eyes. Details of four other varieties, previously described elsewhere, are also included.

631 Young, L. C., Davies, H. T., Young, D. A. & Munro, J.
Fundy: a new smooth, early maturing variety of potato.
Amer. Potato J. 1960 : **37** : 274–77.

Fundy, derived from a cross between the Canadian variety Keswick and the USDA seedling 96–56, is early to midseason in maturity and is superior to most early varieties in that the tubers are shallow eyed and attractive in appearance. It approximates to Irish Cobbler in yielding ability; when grown as a main crop in New Brunswick, it has outyielded Katahdin by a small margin. The dry-matter content is only medium but cooking quality is considered excellent both for boiling and baking purposes. Fundy carries the gene R_1 for resistance to late blight but is susceptible to some or all strains of viruses A, B, X and Y.

632 Brücher, H.
Problematisches zum Ursprung der Kulturkartoffel aus Chiloé. (**Problems of the origin of the cultivated potato from Chiloé**).
Z. Pflanzenz. 1960 : **43** : 241–65.

Arguments in favour of the cultivated potato originating from Chiloé are examined and rejected. It is pointed out that no wild potato from Chiloé combines the characters required of an ancestral type. Diploid culinary potatoes were found in cultivation on Chiloé and it is suggested that these belong to the *Solanum stenotomum* group previously thought to be endemic to the Altiplano. The triploid known as Palmetta in Chiloé is also found in north Argentina. It is suggested that potato varieties migrated from the north to the south at some time in the past but that there was no migration from Chiloé across the Cordillera to the Altiplano. *Oxalis tuberosa* was probably introduced into Chiloé along with the Altiplano potatoes.

633 McMahon, R. M., Witkus, E. R. & Berger, C. A.
Some cytological characteristics of 2,4-D-induced mitosis in polyploid cells of *Solanum tuberosum* L.
Caryologia 1960 : **12** : 398–403.

As in the tomato [cf. XXVII, 2391], polyploid cells in the cortical parenchyma and collenchyma divided after treatment of the plants with 2,4-D. Division was at a slower rate than in typical diploid mitosis. It appeared that prophase was shortened and prometaphase lengthened, with the result that the chromosomal fibres were very clearly evident during the latter stage. Prior to congression, the chromosomes were scattered irregularly over the tripolar spindle. Metaphase plates and anaphase separation were however regular. During late prophase and prometaphase, some cells contained chromosomes contracted to such a degree as to be spherical.

634 Brücher, H.
Über das Vorkommen einer kultivierten triploiden "Wildkartoffel" am Nahuel-Huapi-See in Südargentinien. (**On the occurrence of a cultivated triploid "wild potato" at the Nahuel-Huapi Lake in south Argentina**).
Züchter 1960 : **30** : 77–80.

This wild form cannot be an ancestor of the **4*n*** culinary potato, which it resembles, because it is a triploid; its origin is uncertain. *Solanum diemii* is the name suggested for this species which seems not to have been described before. Its tubers have a pleasant taste and the yield from one plant may exceed 1 kg. This form is resistant to *Phytophthora* and mosaic virus.

635 Kawakami, K. & Matsubayashi, M.
Studies on the haploid plants of *Solanum tuberosum*. I. Morphological characteristics of the polyhaploid plants.
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 10–18.

A detailed morphological description is given of a haploid plant of the variety Deodara obtained after pollinating the normal diploid with pollen from *Solanum rybinii*.

636 Meinl, G. & Raeuber, A.
Über die Spaltöffnungsverhältnisse von Kartoffelsorten verschiedener Reifegruppen. (**On the stomatal relationships of potato varieties of different maturity groups**).
Züchter 1960 : **30** : 121–24.

Comparable leaves of a number of varieties grown under comparable conditions at Gross-Lüsewitz in northern Germany were investigated by placing a drop of xylol on their under surface. The rate at which it penetrated the leaf served as a measure of the size of the stomatal apertures. Varieties in the early group had significantly larger stomata than the late-maturing varieties, though significant differences were found between varieties within each group. The early group had the lowest number of stomata per unit area and in general larger cells also in other tissues.

637 Krug, H.
Zum photoperiodischen Verhalten einiger Kartoffelsorten. I. Teil. II. Teil. **(On the photoperiodic behaviour of some potato varieties. I and II).**
Europ. Potato J. 1960 : **3** : 47–79, 107–36.

In both the early variety Erstling and the late variety Ackersegen, tested under greenhouse conditions, short days induced early tuber formation while long days induced earlier flowering and later but higher yields of tubers. The critical day lengths, in which the decrease in tuber formation and the enhancement of flowering were most closely dependent upon day length, were 12–14 hr. for Ackersegen and rather longer for Erstling. The approximate number of 12 hr. photoperiods required to induce an irreversible short-day reaction was 24 for the early varieties Vera and Erstling, 30 for the medium-early variety Bona and 36–40 for Ackersegen. Under field conditions, with the potatoes planted at a series of different dates, photoperiodic reaction was masked by climatic effects but was most masked during the period of critical day length; this period corresponded with emergence at the end of March in Erstling and at the beginning of September in Ackersegen. From the results it is concluded that (1) a late variety, in order to give high final yields of tubers, should have a short critical day length and a quantitative photoperiodic response as regards tuber formation and (2) an early variety should have a longer critical day length and a less marked photoperiodic reaction.

638 Avdeeva, Z. K.
(Raising potatoes from seed employing the transplanting method).
Izv. timirjazev sel'skohozjajstv. Akad. (News Timirjazev agric. Acad.), 1960 : No. 2 : 201–06. [Russian].

An account of raising selfed seedlings of many varieties in small peat blocks for transplanting to open ground at the Horticultural Research Station of the Timirjazev Agricultural Academy is given. Some varieties which produced high tuber yields and a large proportion of marketable tubers are listed. Worth mention are varieties Kinel'skij Bogatyr' [Kinel' Hero], Kameraz and Ėpron, the seedlings of which were the most productive.

639 Buck, R. W. (Jun.).
Male sterility in interspecific hybrids of *Solanum*.
J. Hered. 1960 : **51** : 13–14.

Male sterility, as expressed by pollen abortion, was found to occur in F_1 hybrids between certain clones of the self-compatible species *S. verrucosum* and six self-incompatible *Solanum* species. The male sterility in these hybrids results from the interaction between the cytoplasm of *S. verrucosum* and a single gene from the self-incompatible species. Two types of cytoplasm, one producing plants with aborted pollen and the second producing plants with normal pollen, are present within the species *S. verrucosum*.

640 Maierhofer, E.
Die "Knollenbildungsperiode" in der Beurteilung von Sämlingen und Kultursorten der Kartoffel. **(The "tuber-forming period" in judging seedlings and cultivated varieties of potato).**
Bodenkultur 1959 : **10** : 342–50.

Harvesting was carried out on a series of dates between 16 June and 1 September. The average number of tubers per plant on early and medium-early varieties increased rapidly up to 24 June, thereafter decreasing and finally reaching a steady value. Medium-late varieties showed no reduction in tuber number but varied in the length of the tuber-forming period. These results are explained with reference to the photoperiodic requirements of the different varieties and the weather conditions during the period of tuber formation. Varieties differ in their ability to adapt themselves to weather conditions by reducing the number of tubers. Findings reported elsewhere have been confirmed [cf. XXIX, 480]. The importance of the characters critical photoperiodic requirement, tuber number and length of the tuber forming period in determining yield is discussed.

641 Vogel, J.
Untersuchungen über die Höhe der Schälverluste bei Kartoffeln. **(Investigations on the extent of peeling losses with potatoes).**
Züchter 1960 : **30** : 57–61.

Losses after hand and machine peeling were determined for varieties of the potato collection of the German Democratic Republic and some breeding lines and the factors affecting peeling losses were investigated. The results indicate that in breeding culinary potatoes, selection for shallow eyes and medium-sized tubers of regular form should be carried out. Round tubers are most suitable for the cylinder type of peeling machine. Smaller tubers have the greatest losses with hand peeling and the largest tubers have most waste with machine peeling.

642 ZADINA, J.
Příspěvek k otázce významu barvy slupky a dužniny u průmyslových odrůd bramborů. **(A contribution to the problem of the importance of the colour of the flesh and skin in industrial varieties of potato).**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 621–30.

Studies of many varieties in a world collection showed that the industrial quality does not depend on the colour of the flesh or skin of the tuber. The demand for white varieties in Czechoslovakia is making the breeding of industrial potatoes unnecessarily difficult.

643 LAMPE, K.
Die Widerstandsfähigkeit von Kartoffelknollen gegen Beschädigungen. **(The resistance of potato tubers to damage).**
Europ. Potato J. 1960 : **3** : 13–29.

The resistance of tubers to mechanical injury, as measured with an instrument which, by means of a sliding weight on a weighing lever, causes a pressure pin to penetrate the tuber [cf. XXX, 537], corresponded closely with resistance to injuries caused by a mechanical harvester. Varietal differences in resistance were detected, but those due to locality were greater. Weather and storage conditions also affected varietal reaction.

644 CORRELL, D. S.
An anomaly in Solanum.
Wrightia 1959 : **2** : p. 23.

Some further observations are made on the plant designated *Solanum pennellii* [cf. XXIX, 1725] which appears to be intermediate in some respects between *Solanum* and *Lycopersicon*; it is no longer regarded as a member of section *Tuberarium.*

645 OCHOA, C.
Nuevas especies de *Solanum* (*Tuberarium*, subsec. *Hyperbasarthrum*) del Perú. I. II. III. **[New Peruvian species of *Solanum* (*Tuberarium*, subsec. *Hyperbasarthrum*). I. II. III].**
Agronomía, Lima 1959 : **26** : 109–13; 217–22; 312–22.

The following new species and varieties are described: *S. huancabambense*, *S. mochiquense*, *S. pascoense*, *S. cantense*, *S. cuzcoense*, *S. ayacuchense*, *S. cajamarquense*, *S. chancayense*, *S. ingaefolium*, *S. weberbaueri* var. *decurrenti-alatum* and *S. chiquidenum* var. *cachicadense* [cf. XXVI, 3467].

646 ROSS, H.
Über die Zugehörigkeit der knollentragenden *Solanum*-Arten zu den pflanzengeographischen Formationen Südamerikas und damit verbundene Resistenzfragen. **(The relationship of tuber-bearing *Solanum* species to the plant geographical formations of South America and related problems of resistance).**
Z. Pflanzenz. 1960 : **43** : 217–40.

Observations were made on *Solanum* species growing in different vegetation zones and note taken of the ecological conditions and pathogens present in the zones. These studies indicate that species from the hygrophytic montane and mist forests may be expected to be resistant to *Phytophthora*, *Alternaria*, *Synchytrium* and *Erwinia phytophthora*, whilst species from the mesophytic lowland and montane scrub may be resistant to viruses transmitted by insects and those from the xerophytic lowland and montane thorny scrub resistant to *Streptomyces*, *Spongospora* and nematodes. Species from the thorny scrub regions showed most resistance to drought and those from the damp, dry and thorny moorland regions were most resistant to frost.

The influence of human activities on the distribution of *Solanum* species is discussed.

647 NIELSEN, L. W. & HAYNES, F. L. (JUN.).
Resistance in *Solanum tuberosum* to *Pseudomonas solanacearum*.
Amer. Potato J. 1960 : **37** : 260–67.

A total of nearly 9000 domestic and foreign potato clones were planted in North Carolina soils naturally infested with *Ps. solanacearum* and were also artificially inoculated in the greenhouse. Their response to the pathogen was compared with that of the susceptible variety Irish Cobbler. No clones showed complete resistance to the disease but in certain medium and late-maturing clones, including Prisca, 2117–117 and 2446–26, the appearance of symptoms was delayed and the disease developed very slowly, indicating partial resistance. The reaction of some clones varied from year to year while certain clones showed a lack of correlation in their response to infection in the field and greenhouse. Hybridization studies indicated that resistance was heritable; however the resistance obtained by crossing resistant clones of different genetical background was no better than that of the parents.

648 Guzman Naranjo, J., Thurston, H. D. & Heidrick, L. E.
Resultados sobre la naturaleza de la resistencia parcial de tres clones de papa al *Phytophthora infestans* (Mont.) de Bary. [**Results on the nature of the partial resistance of three clones of potato to *Ph. infestans* (Mont.) de Bary**].
Agricultura trop. 1960 : **16** : 89–99.

The Central Collection of potato varieties in Colombia contains certain clones within the species *Solanum tuberosum*, *S. andigenum* and *S. phureja* which possess partial field resistance to blight. Three clones of each species were examined to determine the correlation between certain aspects of the disease and varying degrees of partial resistance. The three clones included one described as highly resistant, one with medium resistance, and one with high susceptibility to the disease. Race 0 was used. The results indicated a negative correlation between the degree of resistance and the following manifestations of the disease; speed of sporulation, quantity of spores produced, relative size of the lesion, and development of the disease as measured by the number of lesions produced. However, in the case of two other aspects of the disease, period of incubation and speed of penetration, no correlations were found.

649 Tomiyama, K.
Some factors affecting the death of hypersensitive potato plant cells infected by *Phytophthora infestans*.
Phytopath. Z. 1960 : **39** : 134–48.

By means of vital staining with neutral red and the observation of protoplasmic streaming, the time required for hypersensitive death of the exposed cells of longitudinally cut leaf stalks infected with different races of *Ph. infestans* was measured. In the resistant stalks, hypersensitive death occurred earlier if the cut surfaces were exposed to air for several hours before inoculation than if they were inoculated immediately after a brief washing; the intracellular hyphae were still alive at the time of cell death. These and other results suggest that hypersensitive death is hastened by treatment accelerating the metabolic activity of the host cells. In susceptible material, exposure to air was without effect. In the five varieties studied, it was found that the weaker the resistance, the longer the time required for hypersensitive death to occur.

650 Toxopeus, H. J.
Studies on the resistance of tuber-bearing *Solanaceae* from Mexico to *Phytophthora infestans*.
Euphytica, Wageningen 1960 : **9** : 39–56.

Among 12 *Solanum* species tested by inoculation with races 4; 1,2,4; 1,3,4; 2,3,4 and 1,2,3,4, interclonal crosses in *S. bulbocastanum* and clones of *S. polytrichon* proved to be highly resistant. Their reactions could not however be interpreted in terms of the presence or absence of *R* genes and it is thought that genes for field resistance as well as for hypersensitivity are present. *S. bulbocastanum* was successfully crossed only with *S. cardiophyllum*, *S. sambucinum* or *S. jamesii* as mother plants, but *S. polytrichon* could be crossed reciprocally with several species including *S. chacoense* and *S. goniocalyx*. By doubling the chromosome number of the F_1 of *S. polytrichon* x *S. chacoense*, cross fertility with *S. tuberosum* has been achieved. F_1 plants of *S. polytrichon* x *S. goniocalyx* were highly resistant to the four races. Resistance to all four races was found also in clones of *S. semidemissum*, *S. cardiophyllum* and *S. vallis-mexici*.

651 Denward, T.
Växtförädling med potatis. (**Potato breeding**).
Sverig. Utsädesfören. Tidskr. 1960 : **70** : 17–58.

Consisting mainly of a survey and discussion of published work on breeding in *Solanum tuberosum*, the use of wild species as sources of resistance to pests and diseases, breeding work at the Swedish Seed Association, photoperiodic behaviour and the genetical basis of resistance to various diseases, this paper also describes the following work. Among clones from five cross populations, grown under similar conditions, some 25% consistently showed the marked stolon formation of the wilding type, about the same proportion formed no wildings and the remainder varied in different years. These differences result from differences in day-length response, and one population was strikingly better than the others in this respect and one considerably worse. The percentage of round tubers varied between 58% in one population and 82% in another. Interclonal differences in productivity and interpopulational differences in consistency of yield were detected. The breeding procedure used by the Swedish Seed Association involves (1) crossing, (2) germinating the seed on filter paper, (3) planting the seeds individually in pots, (4) planting out one tuber from each pot to give the K_0 in which selection is effected, (5) multiplication and selection in three different localities, and (6) comparative testing and further multiplication of selected clones. Crosses with *S. andigenum* have been effected with a view to obtaining eelworm-resistant material. Studies on biotypes of *Phytophthora infestans* have shown that: (*a*) different races differ significantly in virulence; (*b*) it is possible to obtain races with only one pathogenicity factor from the complex race 1,2,3,4; races 1 and 4 have been obtained in this way; and (*c*) with monospore cultures of races 1 and 4 as starting material, it has proved possible, by successive adaptation on suitable potato genotypes, to develop race 1,2,3,4. Adaptation has however not been effected with respect to the resistance gene R_2, and plants with this gene generally escape infection in the field, suggesting that it is likely to be useful in breeding.

652 Umærus, V.
Iakttagelser rörande fältresistens mot bladmögel (*Phytophthora infestans* [Mont.] de By) hos potatis. [**Observations on field resistance to late blight (*Ph. infestans* [Mont.] de By.) in potato**].
Sverig. Utsädesfören. Tidskr. 1960 : **70** : 59–89.

Resistance to penetration can be measured by means of a technique in which a spore suspension of known concentration is sprayed uniformly on to detached leaves which are then incubated at 100% relative humidity and 15–20° C. A number of *Solanum demissum* x *S. tuberosum* derivatives and, to a lesser extent, Ackersegen required a longer minimum incubation period and showed fewer total lesions than the less resistant variety Anna.

Resistance to invasion, which may be determined from the rate of mycelial growth, i.e. from the necrotic area attained in a given period, from the degree of sporulation or from the period required for 50% defoliation, varied according to variety. Peroxidase activity was also closely related to resistance [cf. XXVIII, 4380]. In a comparison of the effects of 10 hr. and 17 hr. photoperiods on four varieties, tuber yields (early lifting) were appreciably higher under short than long days, except in Bintje, but with later lifting there was less difference due to day length. In inoculated plants, number of necroses, mycelial growth and sporulation were considerably greater under short than under long days, and number of days to 50% leaf loss and peroxidase activity were lower, the susceptible variety Bintje showing the least photoperiodic response. Tuber rot, except in Bintje, was greater under long days. It is recommended that in breeding for resistance, the first stage of selection should be for plants requiring a long incubation period in the penetration test referred to above, and that subsequent selection for invasion resistance may be effected by testing for peroxidase activity.

653 Proudfoot, K. G. & Sproule, T. R. M.
An improved technique for the isolation of *Phytophthora infestans*.
Europ. Potato J. 1960 : **3** : 155–57.

The above technique, in which cores are removed from naturally or artificially infected potato tubers and incubated in boiling-tubes at 18° C., allows the isolation of different races, the production of large quantities of inoculum and the maintenance of cultures for long periods.

654 Cole, C. S. & Howard, H. W.
The effect of growing resistant potatoes on a potato root eelworm (*Heterodera rostochiensis* Woll.) population.
Nematologica, Leiden 1959 : **4** : 307–16.

The second author's theory that *Solanum andigenum* clones CPC 1673, 1685 and 1690 might contain different resistance genes was not supported by these experiments. Lines bred from the clones were equally attacked by the resistance-breaking eelworm biotype [cf. XXIX, 3597].

655 Thijn, G. A.
Vererving van resistentie tegen aardappelviren. (**Inheritance of resistance to potato viruses**).
Zaadbelangen 1960 : **14** : 233–34.

In cross combinations tested in the Netherlands for resistance to leaf roll and virus Y, the potato Bl.5444 was an exceptionally good parent, and Aguila,* Libertas, Maritta and 354 also transmitted resistance in most combinations.

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* ? Aquila.

656 MUNRO, J.
The reactions of some potato varieties and seedlings to potato virus F.
Amer. Potato J. 1960 : **37** : 249–56.

Two strains of potato virus F were used to infect 30 potato varieties and seedlings. Mechanical inoculation did not cause symptoms but severe necroses developed when the plants were graft inoculated. A joint inoculation of virus F and potato virus A, X or Y led to brown necrotic lesions and blotches. One strain of the virus caused tuber necrosis in all plants inoculated while the other induced symptoms in only four varieties.

657 BAGNALL, R. H.
Potato virus F latent in an imported variety and resistance to the virus in an interspecific potato hybrid.
Phytopathology 1960 : **50** : 460–64.

A number of wild tuber-bearing *Solanum* species and interspecific hybrids were inoculated with virus F from symptomless plants of Albion. Plants of PI197772 (*S. tuberosum* 'Epicure' x 4*n S. chacoense*) remained free of symptoms and the virus could not be recovered. Twenty-four seedlings from selfed plants were also resistant. When the hybrid was infected by grafting, the necrotic lesions were localized.

A selection of 2*n S. chacoense*, PI 175,443, was also inoculated with virus F, and the virus was not recovered.

658 RUSCHKE-HEILMANN, U.
Über ein Verfahren zur zellphysiologischen Markierung virusbefallener Zellen und seine Anwendung zum Nachweis der Kartoffelvirosen an der Knolle. **(On a procedure for cytophysiological marking of virus-infected cells and its application in demonstrating the presence of potato viruses in the tuber).**
Europ. Potato J. 1960 : **3** : 164–81.

A method has been developed to enable breeders rapidly to identify tubers infected with the S, X, leaf-roll, Y, A or bouquet viruses. Staining with acridine orange followed by Bordeaux red allows degree of infection of phloem cells by leaf roll, Y, A or bouquet to be determined and the presence of virus X or S in phloem cells to be detected.

659 **Jottings for growers.**
Seed World 1960 : **86** : No. 3 : p. 31.

Tanhoma, a new sweet-potato variety released by Oklahoma Agricultural Experiment Station, is similar in appearance to Porto Rico, but is less susceptible to wilt, stem rot and internal cork than that variety. Its principal weakness is its susceptibility to nematodes.

660 MILLER, J. C., HERNANDEZ, T. P., HERNANDEZ, T. P. & MARTIN, W. J.
Centennial. A new sweet potato variety.
Circ. La. agric. Exp. Sta. 1960 : No. 63 : unpaginated.
Centennial sweetpotato.
Crops & Soils 1960 : **12** : No. 9 : p. 25.

A derivative of Unit 1 Porto Rico x Pelican Processor, Centennial has bright copper skin colour, deep orange flesh, well-shaped roots, good storage, baking and canning quality and some resistance to *Fusarium oxysporum* f. *batatas*, *Albugo ipomoeae-panduranae* and internal cork. Widely adapted in Louisiana, it is the most productive variety developed in that state. The roots contain 17 mg. or more carotene per 100 g. fresh weight, as compared with 6 for Unit I Porto Rico and 12 for Goldrush.

661 POPE, D. T., NIELSON, L. W. & HOOVER, M. W.
Disease resistant new sweet potato variety.
Res. & Fmg. 1960 : **18** : p. 7.

Resistant to internal-cork virus and tolerant of *Fusarium* wilt, the new sweet potato Nugget has surpassed Porto Rico in yield of both marketable and No. 1 roots in tests in North Carolina. The skin is copper coloured and the flesh a uniform orange. The variety possesses acceptable baking quality and has given a good performance in canning and freezing tests. The roots are free from discoloration when cut.

662 AMPEY, R. M.
Carotene distribution in the sweet potato.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–543 : p. 3482. (Abst.).

Of three varieties tested, Queen Mary had the highest, Porto Rico Unit I the next highest, and Porto Rico the lowest concentration of carotene. Queen Mary and Porto Rico were superior to Porto Rico Unit I in retention of carotene during storage.

663 GIAMALVA, M. J., MARTIN, W. J. & HERNANDEZ, T. P.
Reaction of 8 sweet potato selections to 5 species of root-knot nematodes.
Phytopathology 1960 : **50** : p. 575. (Abst.).

Sweet potato varieties Porto Rico, Goldrush, Acadian, Heartogold, Allgold, Nemagold and Louisiana seedlings 1–80 and 3–77 were grown in steam-sterilized soil artificially infested with *Meloidogyne arenaria*, *M. hapla*, *M. incognita acrita* and *M. javanica.* The varieties differed greatly in reaction to the given species. *M. incognita* caused slight galling and developed mature females in Heartogold only. On Nemagold, slight galling and development of mature females was induced by all species except *M. arenaria*, which, however, caused slight to moderate root necrosis on all varieties. *M. incognita* and *M. incognita acrita* caused the most severe galling on all selections.

664 Carlson, L. W. & Struble, F. B.
Techniques for evaluating sweet potato lines for their reaction to soil rot.
Phytopathology 1960 : **50** : 574–75. (Abst.).

Varietal resistance to *Streptomyces ipomoeae* was found to be greatest in lines having a small number of layers of enucleate periderm cells and an abundant, rapid-developing root system.

FIBRES

665 Schuphan, W.
Gustav Bredemann zum 80. Geburtstag. (**Gustav Bredemann on his 80th birthday**).
Qual. Plant. Mater. veg. 1960 : **7** : 137–38.

A biographical note is given on Bredemann whose many activities include fibre-plant breeding.

666 Arruda, H. V. de
Estimativa da eficiência do delineamento "látice balanceado" em relacão a "blocos ao acaso". (**Estimation of the efficiency of the balanced lattice layout in comparison with randomised blocks**).
Bragantia 1959 : **18** : XLIII–XLVI.

A chain of cotton trials involving 25 varieties in various Brazilian localities showed that the balanced lattice layout had 1·18 the efficiency of the randomized block design.

667 Méndez R., E. D.
Mejoramiento genético del algodonero, campaña 1959. (**Genetical improvement of cotton, 1959 season**).
Inf. mens. Estac. exp. agríc. La Molina 1960 : **34** : No. 392 : 1–7.

Further progress in cotton selection and breeding in Peru is reported [cf. XXX, 2910]. Of the 241 wild and cultivated cotton varieties available, 103 have now been selected as potential breeding material because of their earliness, yield and fibre quality. Selection for the same factors has continued in crosses involving Tangüis and in progenies of other intervarietal crosses. Of the Tangüis selections treated with X rays, 75 are being studied further. Work has also continued with FW–450. In fibre-yield trials of hybrid material, no significant differences were obtained between the best control variety, Tangüis LMW 2447–54, and three hybrids, 2872–56, 318–54 and 2842–56. The last-named hybrid, derived from U4 x Tangüis LMW 467–45, continues to show outstanding qualities.

668 Giles, J. A.
The comparative genetics of *Gossypium hirsutum* L. and the synthetic amphiploid, *Gossypium arboreum* L. x *Gossypium thurberi* Tod.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–6561 : p. 2507. (Abst.).

Amphiploid *G. arboreum* x *G. thurberi* was crossed with multiple dominant and recessive marker stocks of *G. hirsutum* for a comparison of the two diploid species with the corresponding A and D subgenomes of *G. hirsutum.* Ten mutations in *G. hirsutum*, characterized by monofactorial segregation, were used. The genome location of six of these had been determined previously. The present investigations provided evidence that the mutant characters of cup leaf, "nectariless" and virescent yellow were associated with subgenome A of *G. hirsutum.* Both diploid species had dominant genes corresponding to five of the *G. hirsutum* mutants. In the cases of cluster, crinkle and virescent yellow the diploids did not carry dominant alleles homologous with the *G. hirsutum* mutations. Genome A from *G. arboreum* masked the mutations for cluster and crinkle in D of *G. hirsutum*, while mutation for virescent yellow in subgenome A of the latter species was masked by a dominant gene in *G. thurberi.* The *G. hirsutum* linkage group, leaf shape—crinkle—green lint, was analysed after a segment of the *G. thurberi* chromosome carrying *L* for narrow leaf had been transferred to the corresponding *G. hirsutum* segment. The cross-over percentage between the genes for leaf shape and crinkle was reduced, presumably because of differences between the *G. thurberi* and *G. hirsutum* chromosomes. As a secondary effect, the percentage of recombination between crinkle and green lint increased, as compared with the cross-over percentage in pure *G. hirsutum* stocks.

669 McMichael, S. C.

Combined effects of glandless genes gl_2 and gl_3 on pigment glands in the cotton plant.

Agron. J. 1960 : **52** : 385–86.

The glandless condition in *Gossypium hirsutum* depended upon two genes, gl_2 and gl_3 [cf. XXX, 1763]. The effect of a third gene, gl_1, inherited independently, was masked by gl_2 and gl_3. Glandlessness was recessive in the seedling stage but partially dominant in the mature plant. The possible approach to breeding for glandlessness and thus for the concomitant reduction in gossypol content of the seed is discussed.

670 Wallace, M. E.

Possible cases of affinity in cotton.

Heredity 1960 : **14** : 263–74.

The author analyses previously reported data on linkages on the basis of the theory of affinity, according to which centromeres of the same ancestral origin tend to pass to the same pole at meiosis I, quasilinkages thus being produced [cf. XXIV, 11 and XXVIII, 3658]. Certain discriminative features of the phenomenon are noted as follows. "(i) Association of markers known to be independent: recombination values may be less than 50 per cent. or more, depending on centromeric phase. Recombination in excess of 50 per cent. (reversal) is particularly discriminative since only in the case of chromatid interference can this occur in chromosomal linkage and then it is not usually expected to exceed 56 per cent. (ii) Non-linear linkage and quasi-linkage relations of segregating markers." Firstly, Knight's data on the behaviour of B_2 and B_3 of *Gossypium hirsutum* race *punctatum* in transferences to *G. barbadense* [cf. XIV, 1091] are shown to fit the hypothesis of affinity equally as well as that of chromosomal linkage. If the association between B_2 and B_3 is accepted as being due to affinity, the two genes are situated near the centromeres of nonhomologous chromosomes of race *punctatum*, these centromeres differing from those of the corresponding chromosomes of *G. barbadense*. It is also concluded that, in general, loose linkages established only by interspecific data may not be acceptable as being unquestionably chromosomal, particularly if the data are from heterozygotes representing only one phase (repulsion or coupling). Hutchinson's data on linkage group L–Lc_1 within *G. arboreum* [cf. IV, 861] and Silow's on linkages R_3 [cf. XI, 872] are also satisfactorily interpreted by the theory of affinity, the following conclusions being reached on this basis. L and R_2 are situated near their centromeres and centromeric differences occur within *G. arboreum* between vars. *bengalense* and *soudanense*. Lc_1 is probably nearer its centromere than L and there may be centromeric disparities within var. *burmanicum*. R_3 is near the centromere and centromeric differences exist between *G. anomalum* on the one hand and either or both of the species *G. herbaceum* and *G. arboreum* on the other. Linkage group 1 (L–Lc_1) is in a different chromosome from groups 7 (R_2) and 6 (R_3).

671 Rhyne, C. L.

Linkage studies in Gossypium. II. Altered recombination values in a linkage group of allotetraploid *G hirsutum* L. as a result of transferred diploid species genes.

Genetics 1960 : **45** : 673–81.

"The substitution of diploid genes, particularly from *G. raimondii* $2D_5$, to the D_h linkage of *G. hirsutum*, specifically at the *R*, or *Yg* and *dw* loci of the *cl–R–Yg–dw* linkage group, caused genetic recombination between the *cl–R* loci to increase significantly, the *R–Yg* recombination to remain the same or to show an increase as compared with the D_h control hybrids. The altered recombination, an increase in one region and a decrease in another region, corresponds to the expectation if chiasmata position were being shifted in the presence of small structurally altered segments of chromatin". [Cf. XXIX, 4116]. [From author's summary].

672 Kammacher, P.

Relations cytologiques entre l'espèce sauvage *Gossypium raimondii* Ulb. et les espèces cultivées de cotonniers *G. hirsutum* L. et *G. barbadense* L. (**Cytological relationships between the wild species *G. raimondii* Ulb. and the cultivated species of cotton *G. hirsutum* L. and *G. barbadense* L.**).

Cot. et Fibr. trop. 1959 : **14** : 353–56.

Cytological analyses of F_1 hybrids of *G. raimondii* ($2n = 26$) with *G. barbadense* ($2n = 52$) and with *G. hirsutum* ($2n = 52$) are briefly reported. All the American diploid species of *Gossypium* carry the D genome. From the data obtained on chromosome conjugation in the present study, it appears that the D genome of *G. raimondii* is the most closely related to the D genomes of the amphiploid species of *Gossypium*.

The presence of univalents, bivalents, and multivalents was noted in both hybrids. A peculiar association of four chromosomes appeared with regularity in the F_1 of *G. hirsutum* x *G. raimondii*. A detailed study revealed that this aberration was due to a reciprocal translocation between a *G. hirsutum* and a *G. raimondii* chromosome. This observation helped to establish that a major chromosome rearrangement has taken place during the course of evolution in the D genome of *Gossypium*. The subgenomes of *G. hirsutum* exhibit a lesser degree of cytological differentiation than those of *G. barbadense*; and of the two amphidiploids the former is more closely related to *G. raimondii*. The evidence from the present study suggests that the two cultivated species have originated independently from different diploid progenitors. The results have also illustrated that *G. raimondii* offers more promise than any other American diploid species for introducing new economic characters into the varieties of *G. hirsutum* and *G. barbadense* by means of interspecific hybridization.

673 DEMOL, J. & NICLAES, J.
Les hybrides trispécifiques dans l'amélioration de la résistance des fibres des cotonniers congolais. **(Trispecific hybrids in the improvement of fibre strength of Congolese cottons).**
Bull. INÉAC 1960 : **9** : 129–36.

Back-crossing with two East African varieties, 2 Ston 26 and Bar 7/8, led to the selection of 407, a line which was superior to the control variety Stoneville with respect to yield and disease resistance. Its fibre-strength properties, however, were unsatisfactory.

Material derived from a trihybrid cross, *Gossypium hirsutum* x *G. arboreum* x *G. thurberi*, was used as the basic material in a pedigree selection programme. Selected plants of this constitution were hybridized, then back crossed with different commercial varieties. Two series of lines were obtained, HR1 and HR2; extensive tests of fibre quality indicated that HR1 was the better but both were superior to the control Stoneville 5. However, both HR1 and HR2 types were susceptible to wilt and lower-yielding than Stoneville 5.

Recurrent selection has now been adopted with a view to breaking the apparent linkage between favourable technological qualities and unsuitable agronomic characteristics. The wilt-resistant varieties Bambesa 49 and 1021 have been crossed with two trihybrid lines with high fibre strength, 1006 and HR1–219–298, and with two varieties resistant to bacteria, Blight Master (Stoneville 20) and Reba TK1. The progeny resulting from these crosses are now being subjected to further selection.

674 **New cottons for Tungabhadra tract.**
Indian Fmg. 1960 : **10** : No. **4** : 26–27.

Two new varieties, suitable for the cotton-growing lands of the Tungabhadra Project, have been developed in India. One of the strains, 2196–4, is highly resistant to black arm; it is late maturing and a rather poor yielder but its ginning percentage and staple length are satisfactory. The other strain, 1821–1–1, shows high resistance to damage by jassids, together with good staple length and ginning percentage. It segregated from an interspecific hybrid obtained from Surat.

It is stated that the introduction of Cambodia cotton on irrigated black soils has not proved successful, while a certain American variety (unidentified) has gained wide acceptance in the western area of Mysore and Andhra Pradesh.

675 ROUX, J. B. & CHIRINIAN, G.
Recherche d'haploïdes dans des variétés de cotonnier Upland (*G. hirsutum*). **[The search for haploids in some varieties of Upland cotton (*G. hirsutum*)].**
Cot. et Fibr. trop. 1959 : **14** : 357–62.

Although haploidy in cotton was previously considered exceptional, research work at Bebedjia in 1958–1959 has resulted in the isolation of more than 50 haploid plants from populations of certain varieties of Upland cotton. The precise origin of these haploids is as yet not clear, but it is suggested that they are induced by abnormalities in fertilization. A relatively simple method for the doubling of the chromosome number of the haploids is described. It involves the application of an aqueous colchicine solution both to the terminal bud, and to one or two branches. Several pure strains were obtained in this manner. A systematic search for haploids in present varieties and among the progenies of crosses is suggested as a technique in the selection and breeding of improved cotton varieties.

676 ROUX, J. B. & CHIRINIAN, G.
Essais d'induction de la stérilité mâle sur cotonnier. **(Attempts to induce male sterility in cotton).**
Cot. et Fibr. trop. 1959 : **14** : 363–70.

Experiments carried out at Bebedjia in 1958 and 1959 confirmed that male sterility may be induced in cotton by spraying with an aqueous solution of FW–450 (sodium α,β-dichloroisobutyrate), or MH–30 (maleic hydrazide). Details are given of the recommended times and rates for the treatment.

677 Pate, J. B. & Duncan, E. N.
Evaluation of sodium 2,3-dichloroisobutyrate as a selective male gametocide in cotton.
Agron. J. 1960 : **52** : 506–10.

In a study of the effects of different levels of the above substance on Pope cotton, it was found that, at an application rate of 1·02 pounds per acre, there did appear to be selective toxicity against the male gamete; at this level a high degree of self sterility was obtained with only a minor reduction in yield. Higher treatment levels, however, caused male and female sterility with no marked selectivity against either gamete. Various adverse effects, such as decrease in yield of seed, reduction in boll and seed size and an increase in lint percentage, were observed at these levels.

The average percentages of natural crossing were substantially increased in a series of varieties treated with 2·04 pounds of the gametocide per acre. However the treated plants were less productive, indicating the effects of female sterility and phytotoxicity. It is concluded that the undesirable effects resulting from treatment with the compound seriously limit its use as a selective male gametocide for the commercial production of hybrid cotton.

678 Roux, J.-B.
La sélection des cotonniers sans gossypol. (**The selection of cotton plants without gossypol**).
CR Acad. Agric. Fr. 1960 : **46** : 613–22.

The genetic basis of gossypol-free cotton seed is clarified. The character occurs when two partially dominant and independent genes, *Gl*–2 and *Gl*–3, occur in the homozygous state. The significance of this result for cotton breeding is discussed.

679 Moosberg, C. A.
Progress being made in breeding a smooth-leaf strain of Rex cotton.
Arkans. Fm. Res. 1960 : **9** : No. 3 : p. 4.

The new smooth-leaf strain of Rex cotton was superior in several respects to the standard Rex strain in 1959 Arkansas trials. Total production was slightly higher; the lint contained considerably less foreign matter; the fibre was superior by one grade and produced stronger yarns. The picker and card waste was lower than for the standard Rex strain, a result substantiated by the Shirley test.

680 Stroman, G. N.
Resultados del mejoramiento del algodón peruano Tangüis. (**Results in the improvement of Peruvian Tangüis cotton**).
Bol. Inst. Genét., Perú 1958 : No. 2 : Pp. 21.

Of the cotton grown in Peru, 85% is of the Tangüis type. The aim of the programme, which began in 1954, has been to develop strains improved both in qualitative and quantitative characteristics as compared with the control strain SNA248. In general, the standard field and laboratory measurement techniques have been employed. With a view to obtaining a higher degree of uniformity of fibre length, two further values have been obtained, using Pressley's sorter: (1) the percentage of fibres less than 1¼" in length, and (2) the percentage greater than 1". Lines 2603 and 3958 have proved to be superior but are still defective in certain characteristics. Further improved strains are currently under experimentation.

681 Arnold, M. H.
Lint quality in Lake Province cottons of the future.
Emp. Cott. Gr. Rev. 1960 : **37** : 178–81.

A short account of the value of the Uk series of multiline issues, which retain the lint quality of Mwanza local stocks but are better in yield potential, is followed by information on the quality of the bacterial-blight resistant strains which have now been bred for the Lake Province of Tanganyika, Albar 51 having been used as source of resistance. The strains, still under extensive test, represent three main quality types. In the first group, the present commercial standards of quality have been retained. The second is characterized by high maturity and high mean fibre weight per cm., with yarns similar in strength and appearance to the present commercial strains. Strains in the third group have longer, finer and stronger fibres, thus giving stronger yarns of good appearance. The two latter groups may be considered as cases of transgressive segregation, since the lint quality differs from that which would have been expected from either parent.

682 Gutknecht, J.
Variations des caractéristiques technologiques de quelques variétés de coton cultivées aux États-Unis. (**Variations in the technological characteristics of some cotton varieties grown in the U.S.A.**).
Cot. et Fibr. trop. 1959 : **14** : 395–427.

This review deals with the changes that have occurred in the last 30 years in the Upland cotton varieties in the USA. Statistical data are presented to illustrate the increases in fibre length, and the decline in the grade of the crop during this period.

683 Armstrong, G. M. & Armstrong, J. K.
American, Egyptian, and Indian cotton-wilt fusaria: their pathogenicity and relationship to other wilt fusaria.
Tech. Bull. US Dep. Agric. 1960 : No. 1219 : Pp. 19.

Cultures of cotton-wilt *Fusarium* from the US, Egypt and India were used to inoculate cultivated varieties and breeding lines of *Gossypium arboreum*, *G. barbadense*, *G. herbaceum* and *G. hirsutum*; the wild cottons, *G. anomalum* and *G. thurberi*; and numerous other species of plants. By testing the responses of certain combinations of two cotton varieties, three distinct races could be identified, namely the United States, Egyptian and Indian. The United States *Fusarium* could, however, be further divided into two separate physiological races on the basis of differences in their pathogenicity on Yelredo soya bean and flue-cured tobacco.

The interrelationships of these races with *Fusarium* spp. from other species, such as lucerne, okra and *Cassia tora*, are discussed.

684 Barnes, D. K., Culbertson, J. O. & Lambert, J. W.
Inheritance of seed and flower colors in flax.
Agron. J. 1960 : **52** : 456–59.

The colour of 12 yellow-seeded flax varieties was found to be due to the homozygous condition of one or more major recessive seed-colour genes, b_1, d and g. Using information obtained from crosses, the 12 varieties were grouped into four different genotypes on the basis of the genes that each carried. The varieties were also grouped into five flower-colour classes and crosses among these classes indicated that flower-colour inheritance involved b_1 and d, as well as two other genes, a and f. Details are given of the various phenotypes produced by different combinations of these genes. The genotype b_1b_1, which has previously been reported to be sublethal, appeared to cause a low seed set per fruit and a low germinating power of the resulting seeds. It was observed that varieties with the same genotypes for the major seed-colour genes often had seeds of different shades indicating that there are independent minor genes modifying this character.

685 Flor, H. H.
The inheritance of X-ray-induced mutations of virulence in a urediospore culture of race 1 of *Melampsora lini*.
Phytopathology 1960 : **50** : 603–05.

New genomes for virulence have been induced in a rust culture by X irradiation. The mutations, which proved to be heritable, are attributed to the deletion of a portion of the chromosome carrying closely linked genes for avirulence to the varieties Koto, Abyssinian and Leona. Virulence appears to be conditioned by the absence of a dominant avirulence gene.

686 Trione, E. J.
The HCN content of flax in relation to flax wilt resistance.
Phytopathology 1960 : **50** : 482–88.

Ten varieties of flax, containing varying amounts of HCN in their tissues, were exposed to infection by two clones of *Fusarium oxysporum* f. *lini*, 33–1 and 294. Certain of the varieties possessed resistance to one or both of the wilt clones. It was found that there was no correlation between a high cyanide content in flax varieties and their resistance to either clone of the pathogen.

687 Friederich, J. C.
Mogelijkheden van de teelt van hennep in Nederland. (**Possibilities of growing hemp in the Netherlands**).
Meded. Proefsta. Akker- en Weidebouw, Wageningen 1960 : No. 40 : Pp. 13. (Mimeographed).

In 1952–56 two Sengbusch varieties and in 1957–59 two selections from them, called Fibrimon and Fibrimon 24, were better in yield of stems and fibre and in quality than the varieties with which they were compared.

688 Köhler, D.
Die Vererbung des Blühtermins bei *Cannabis sativa*. (**The inheritance of flowering time in *C. sativa***).
Z. Pflanzenz. 1960 : **42** : 339–55.

Five varieties and crosses between them were studied. Three genes with additive effects were found to control flowering. The German and Italian varieties differed in respect of two genes and the Turkish variety differed from the Italian in respect of the third gene. The cytoplasm influenced flowering time and in diecious varieties the Y chromosome also had some effect on the flowering time of males. The sowing time affected the action of genes and cytoplasm.

689 Patel, G. I. & Datta, R. M.
Interspecific hybridization between *Corchorus olitorius* Linn. and *C. capsularis* Linn. and the cytogenetical basis of incompatibility between them.
Euphytica, Wageningen 1960 : **9** : 89–110.

In numerous reciprocal crosses between *C. olitorius* and *C. capsularis* the pods were always smaller than those obtained by selfing, and the few seeds produced were shrivelled or full but always inviable. Cross compatibility was no greater between types which appeared to be morphologically more closely related and was even lower in crosses involving other species. The rate of pollen germination was similar in crosses and selfings, but in the crosses pollen-tube growth was slower and only a few ovules, situated in the upper part of the ovary, were fertilized.

690 Datta, R. M.
Polyembryony in *Corchorus olitorius* Linn. (Wild).
Sci. & Cult. 1960 : **25** : p. 642.

A single case of twin seedlings is reported. Cytological examination of the seedlings was not possible.

691 Sanyal, P. & Kundu, B. C.
Cytological study of *Hibiscus radiatus* x *Hibiscus cannabinus* hybrid and genomic relationship of the two species.
Nucleus, Calcutta 1959 : **11** : 99–108.

A breeding programme involving *H. cannabinus* and five other species of *Hibiscus* has been undertaken at the Jute Agricultural Research Station, Barrackpore, India, the aims being to incorporate resistance to rot diseases, and to clarify the genetic affinities of the species. Only in the crosses between *H. radiatus* and *H. cannabinus* were full seeds obtained, though in the F_1 plants the percentage was only 0·45%. In the F_2 plants, the percentage of full seeds per plant varied from 0 to 33·87%. The pollen fertility of the F_1 plants was 22·09%, while there was a variation of from 0 to 88·52% in the case of different F_2 plants.
At metaphase, *H. cannabinus* and *H. radiatus* had 18 and 36 bivalents respectively, while the F_1 hybrid had $2n = 54$, and invariably showed meiotic irregularities. The F_2 plants examined had varying numbers of chromosomes, and this is explained on the basis of the union of aneuploid gametes. The authors suggest that *H. radiatus* arose from hybridization between *H. cannabinus* and another species of *Hibiscus*, followed by doubling of the chromosomes. It is suggested that both amphiploidy and structural changes that have occurred in the chromosomes of the parental genomes are responsible for the meiotic irregularities observed in the F_1 hybrid. However, the partial fertility of the F_1 indicates that the two parental species are closely related.

692 Webber, J. M.
Hybridization and instability of *Yucca*.
Madroño, S. Francisco 1960 : **15** : 187–92.

Highly fertile and meiotically regular hybrids have been raised from the following artificially effected crosses: *Y. glauca* x *Y. elata*, *Y. constricta* x *Y. schidigera*, *Y. arizonica* x *Y. neomexicana* and *Y. arizonica* x *Y. glauca*. It appears that the present taxonomic species are not well-defined genetically.

SUGAR AND STARCH PLANTS

Memoria de la XXXII Conferencia Anual. Asociación de Técnicos Azucareros de Cuba. **(Report of the 32nd Annual Conference of the Association of Sugar Technologists of Cuba).**
La Habana 1958 : Pp. 291.

693 *Barreto Domínguez, R. Resultados obtenidos en los estudios comparativos de variedades realizados por la Estación Experimental de la Caña de Azúcar de Jovellanos en la zafra de 1958. (Results obtained in comparative varietal tests carried out by the Jovellanos Sugar-Cane Experimental Station in the 1958 season). (pp. 21–26).*

Further results are reported of trials comparing new varieties of sugar cane with the standard commercial varieties [cf. XXVIII, 4488]. At Baragua, several Cuban varieties, notably C51–53, C86–51 and C236–51, gave significantly higher yields than the controls, POJ2878 and CP29–103. In a trial at Rosario, the outstanding varieties were PR980, C529–50 and

C693–47; they significantly outyielded the controls, POJ2878, PPQK, ML3–18 and POJ2961.

694 Buzacott, J. H.
Progress in the development of new varieties.
Cane Gr. quart. Bull. 1960 : **24** : 7–9.

Sugar-cane breeding during recent years in Queensland is briefly reviewed, with reference to (1) techniques used in cross pollination, fuzz storage, seedling raising, planting out and selection, and (2) the value of the new varieties developed.

695 Mourguet, H.
La Station de Sélection de la Canne à Sucre de la Réunion. (**The Sugar-Cane Selection Station of Réunion**).
J. Agric. trop. Bot. appl. 1959 : **6** 637–52.

In this detailed account of selection and hybridization methods used at the Station, mention is made of some of the most recent varieties produced. R331, itself derived from a cross between Uba-Marot and POJ36, has been crossed with the standard variety POJ2878. Among the hybrids thus obtained were R445 and R447; both are now widely grown in the island, having largely replaced R397 which proved susceptible to gummosis.

696 Barrett, E. R.
Selection in bunch and single planted sugarcane seedling nurseries at Louisiana State University.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–5507 : 2482–83. (Abst.).

A study was made of the Brix value and other characters of (1) selections in stubble stools of the CP 1955 series of crosses planted as single plants and bunches of 10 and (2) clones established from the selections. It was concluded that the two methods of selection would be equally effective as regards Brix and stalk diameter, weight and height. Selection for Brix was not completely effective. If Brix is therefore not used as a criterion in selection, a much larger number of seedlings may be handled with the same facilities. A larger number of clonal plots should however be established from stubble selections so as to permit further testing of a greater number of seedlings. Selection for Brix in 3-ft. clonal plots would be effective for isolating high-sucrose canes. Data on selections in stubble stools of the CP 1956 series of crosses also revealed little difference in the Brix of canes from the bunch and single-plant methods of selection. Survival studies of seedlings in the greenhouse indicated that a high percentage of bunched seedlings are eliminated at random before becoming established in the field. "Field studies also indicate that more than one cane per hill could be selected from plant cane seedlings without obtaining two canes of the same variety at a high frequency. However, selection of more than one per hill in stubble would greatly increase the possibilities of selecting two canes of the same variety".

697 Trippi, V. & Montaldi, E. R.
The aging of sugarcane clones.
Phyton, Vicente López 1960 : **14** : 79–91.

Clonal propagation of flowering plants may be effected by means of cuttings either from vegetative parts which are sexually immature, such as basal shoots, or from parts which are sexually mature and are about to flower or have already flowered. In the former case the clone is physiologically young and, it is thought, will go through a juvenile phase with low yields and then a period of high yields before finally undergoing senile decay; in the latter case aging will take place quickly. To delay aging in sugar cane it is recommended that basal setts be used instead of the usual apical setts. It is further noted that breeders tend to select individuals which give high yields immediately, i.e. which are physiologically precocious; this has the disadvantage that the period of high yield will be followed rapidly by that of degeneration.

698 Nouvelles variétés de cannes. (**New sugar-cane varieties**).
Rev. agric. sucr. Maurice 1960 : **39** : p. 121.

New varieties of sugar cane announced by the Government of Mauritius are M202/45 and M93/48. The former is suitable for all parts of the island, while the latter is adapted to the cold, humid regions of the high plateaux. A third variety, M253/48, is still under observation but appears suitable for warm, humid climates and for irrigated areas.

699 **Co.740, a new variety showing promise in tropical India.**
Indian J. Sugarcane Res. Developm. 1960 : **4** : 245–46.

This new variety, derived from a cross between P3247 and P4775, is an early and profuse-tillering, thick-cane type. In trials in Bombay and Madras States, it has consistently outyielded Co.419 and is also reported to ratoon well. Mill tests have indicated that its juice quality is superior to that of Co.419.

700 **Triton, a promising new cane.**
Aust. Sug. J. 1960 : **52** : p. 220.

Bred by the Colonial Sugar Refining Company from a cross between Co.270 and Eros made in Queensland, Triton is quickly replacing other varieties in New South Wales. It has out-yielded its sister variety Vesta and has several other desirable features such as reliable and rapid germination, good early coverage, ability to grow well on poor to medium soils and resistance to major diseases, flood and frost.

701 KANDASAMI, P. A.
Economic characters of triploids of *Saccharum spontaneum* Linn. and their utilization in sugarcane breeding.
Sci. & Cult. 1960 : **25** : 491–92.

Eleven plants with $2n = 96$ and one with $2n = 168$ were obtained at the Coimbatore Sugarcane Breeding Institute by selfing local *S. spontaneum* ($2n = 64$) and a form of this species from Java ($2n = 112$). The 12 individuals evidently arose through fertilization of unreduced and reduced gametes. Meiotic investigation of some of the derivatives of the Coimbatore form revealed 48_{II} or occasionally $42_{II} + 3_{IV}$. Different degrees of male sterility due to varying degrees of transformation of the anthers into carpellary structures were observed. Since some of the $2n = 96$ derivatives from the Coimbatore parent had a fairly high Brix value (20%), sucrose content (14·57%) and juice purity (83·7%), they may prove useful in the utilization of *S. spontaneum* in breeding.

702 GUILBEAU, W. F., COLL, E. E., FRILOUX, J. J. & MARTIN, L. F.
Processing of new commercial and unreleased sugarcanes: results of clarification experiments during the 1959 season.
Sug. Bull., N. Orleans 1960 : **38** : 226–33.

The results of pilot-plant milling and clarification tests of experimental and recently released varieties, with CP44/101 as standard, are reported from Louisiana. Only CP48/103 was markedly superior to CP44/101 for processing.

703 RAHEJA, P. C.
Relationship of chemical composition of cane varieties and sugar recovery.
Indian J. Sugarcane Res. Developm. 1960 : **4** : 202–08.

Certain problems concerned with the industrial value of old and new sugar-cane varieties are discussed in this review. It is stated that for a variety to be successful, it must possess the following characteristics: a chemical composition which will not cause trouble in the milling department; fibre properties that will not necessitate excessively high demands on fuel; chemical properties which will not create serious problems during the various stages of clarification, crystallization and centrifuging. Each of these points is dealt with in detail, with particular reference to varieties now being grown in India.

704 BAUDIN, P.
Rapport de mission à l'Ile Maurice et à la Réunion. (**The report of a mission to Mauritius and Réunion**).
Rev. agric. Réunion 1960 : **60** : 29–40.

In this report of sugar-cane diseases in Mauritius, Réunion and Madagascar, attention is drawn to the spread of bacterial gummosis, caused by *Xanthomonas vasculorum*, to certain varieties previously considered resistant. In 1959, 43 Réunion varieties were classified in four grades according to their susceptibility to gummosis. It was found that the varieties that showed resistance, such as Ebène 1/37, Vesta, R445, R447.476 and B41.227, were of only limited agronomic value in the island. Stunting disease of the buds has appeared in Mauritius. Of the following three varieties, B34.104, B37.172 and M147.44, the last-named appeared most resistant.

B34.104, which is known to be very susceptible to leaf scald in British Guiana, has proved to be resistant in Mauritius and Madagascar, suggesting the existence of different strains of the bacterial pathogen.

Beiträge zur Rübenforschung. Nr. 3. (**Contributions on beet research. No. 3**).
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1959 : No. 41 : Pp. 50.

The third issue [cf. XXX, 2950–52] comprises the following contributions.

705 *Nötzel, H. Über den Einfluss synthetischer Wuchsstoffe auf die Entwicklung von Wurzelteilstücken der Zichorie* (Cichorium intybus *L.*). [*On the influence of synthetic growth substances on the development of pieces of root in chicory* (C. intybus *L.*)]. (*pp. 7–27*).

The preparations Hormit and UT10 stimulated the development of roots and shoots but had no significant effect on the final yield of the plants.

706 *Staude, H. Toleranzen bei Stichprobenprüfungen von Ploidiegradbedingungen im Handel mit anisoploidem Zuckerrübensaatgut. (Tolerance limits in sampling tests for claims of degree of ploidy in trade with anisoploid sugar-beet seed). (pp. 29–50).*

An explanation is given of the statistical probabilities of deviations in sampling seed lots containing a given percentage of diploids. The opinion is expressed that ideally an upper and lower limit of tolerance, say at $P = 1\%$ and $P = 5\%$, should be employed. If a single limit is accepted, it is suggested that it should be taken at P = 2·5 with the condition that if in the first sampling this limit is exceeded, a second sampling shall be made with $P = 5\%$ as the limit. Tables and nomograms are provided from which it is possible to read the tolerance percentages for samples of different size and with the various ploidy percentages likely to be found in sugar-beet seed, their use being illustrated by examples.

Beiträge zur Rübenforschung. Nr. 4. **(Contributions on beet research. No. 4).**
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1960 : No. 46 : Pp. 92.

The fourth issue [cf. 705–6] contains the following contributions.

707 *Curth, P. Der Übergang in die reproduktive Phase bei der Zuckerrübe in Abhängigkeit von verschiedenen Umweltfaktoren. (The influence of various environmental factors on the initiation of the reproductive phase in sugar beet). (pp. 7–80).*

Observations on 31 May and on 6, 13 and 20 June on four mangel varieties known to differ in tendency to bolt confirmed at each of the dates that the lowest percentage of bolting was in Rote Walze [Red Cylinder] and the greatest in Rosa Beta, with Ideal and Dickwanst intermediate. Large stecklings gave a higher bolting percentage than small stecklings sown at the same time, evidently because they were physiologically more mature.

Experiments with Kleinwanzleben N sugar beet confirmed that treatment of the plants in October with a temperature of + 2° C. increased the tendency to bolt; treatments with fluctuating temperatures were not significantly more effective than a constant temperature of + 2° C. in inducing bolting but vernalized stecklings could be devernalized by subsequent heat treatment at + 30° C. Bolting was increased by growing the plants in continuous light for about 8 weeks after the cold treatment; daily illumination periods of 21 hr. had almost the same effect; the light intensity and wave length were also shown to be important factors. Combined treatment with light and temperature was most effective of all treatments, the most successful combination being 150 lux at 8° C. It is pointed out that the results do not accord with the theory of phasic development.

708 *Sommer, E. Die Anwendung der Leitfähigkeitsmessungen zur raschen Unterscheidung unbehandelten und wasserbehandelten Saatgutes von Zuckerrüben sowie zur Charakterisierung verschiedener Saatgutmuster. (The application of conductivity measurements for rapid distinction between untreated seed and seed treated with water in sugar beets and also for the characterization of different seed samples). (pp. 81–92).*

The electric conductivity was lower in glomerules that had been treated with water than in those untreated.

709 ORLOVSKIJ, N. I.
(The characteristics of sugar-beet breeding in other countries).
Sahar. Svekla (Sug. Beet) 1959 : No. 7 : 44–47. [Russian].

The principal trends in breeding and selection in Europe, the United States and Japan are discussed. The topics covered include polyploidy, the use of male sterility for production of heterotic hybrids and polycrosses, breeding for resistance to bolting, *Cercospora*, virus yellows, leaf curl, *Peronospora* and storage rot, the relations between root and sugar yields and disease resistance on the one hand and ecological conditions on the other, the breeding of beets with reduced ash and noxious nitrogen, and the development of forms with monogerm seed. In this last connexion mention is made of hybridization involving *Beta lomatogona* and *B. patellaris*, said to be valuable also for resistance to virus yellows and other diseases.

710 **Margara, J. & Touvin, H.**
Analyse du comportement en champs d'essais de quelques variétés de betteraves sucrières cultivées en France. II. Essais effectués en 1954, 1955 et 1956. **(Analysis of the behaviour in experimental fields of some varieties of sugar beet cultivated in France. II. Trials carried out in 1954, 1955 and 1956).**
Ann. Inst. nat. Rech. agron., Paris : Sér. B. 1960 : **10** : 53–60.

The results of trials of 11 varieties at 8 centres in France during 1954–1956 have, in general, corresponded with the results of previous trials [cf. XXV, 3279]. The differences in yield observed between varieties were however greater than in previous years. The two polyploids included in the trials, Klein Polybeta and Klein Polybeta Desprez, gave excellent yields, as well as high sugar percentages, at all centres.

711 **Roussel, N., Wauthy, R. & Martens, M.**
Les résultats des essais comparatifs de variétés de betterave sucrière en Belgique de 1955 à 1959. **(The results of comparative trials of varieties of sugar beet in Belgium from 1955 to 1959).**
Publ. Tech. Inst. belge Amélior. Better. 1959 : **4** : 177–203.

A further report [cf. XXIX, 4205] on a continuing series of trials is presented.

712 **Ustimenko-Bakumovskij, A. V.**
(Improving beet varieties by means of numbered élites).
Sahar. Svekla (Sug. Beet) 1959 : No. **7** : 29–32. [Russian].

Two improved biotypes of the sugar beet Ramon' 06 and one of Ramon' 027 were obtained at Ramon' by employing the above method, which combines single plant selection with family selection and progeny testing. The high-yielding form selected from Ramon' 06 yielded 2·7 c. more roots per ha. and 3·9 c. more sugar than the first élite reproduction of this variety in 1956. The corresponding values for 1957 were 7·1 and 6·7 c. per ha. respectively. The other biotype had a 0·7% higher sugar content in 1956 and 1·6% in 1957. The selected form of Ramon' 027 exceeded the initial variety in root and sugar yield in 1956 and equalled it in yield of roots but surpassed it in sugar yield in 1957, the sugar content being 2·1% higher.

713 **Lichter, R.**
Eine verbesserte Pfropfmethode zur Erhöhung der Lebensfähigkeit von Artbastarden zwischen *Beta vulgaris* und Arten der Sektion Patellares. **(An improved method of grafting for raising the viability of interspecific hybrids between *B. vulgaris* and species of the section *Patellares*).**
Zucker, Hannover 1960 : **13** : 146–48.

Crosses of *B. vulgaris* with *B. patellaris*, *B. procumbens* and *B. webbiana* produce good seed but the seedlings mostly die in the early stages owing to defective root development. By grafting such hybrids on to young sugar-beet rootstocks on which 1–3 leaves had been retained a survival of 50–60% was obtained, as against 12% in grafts on rootstocks without leaves. No difference in survival was observed between grafts on diploid, triploid and tetraploid rootstocks. Seedlings differed in the ease with which they could be grafted and the most successful ones can, it seems, be maintained more or less indefinitely as clones by further grafting.

714 **Rapin, J.**
Le contrôle cultural des variétés de betteraves à sucre livrées par la sucrerie et raffinerie d'Aarberg. **(Cultural testing of sugar beet varieties supplied by the Aarberg sugar refinery).**
Rev. rom. Agric. 1960 : **16** : 53–57.

Tabulated information is given on seed characters, root, leaf and sugar yields and resistance to *Cercospora* of diploid and polyploid varieties grown in five regions of Switzerland during 1957–59. The varieties are listed in descending order for each of the characters studied; polyploid varieties were generally superior to diploids.

715 **Essad, S. & Touvin, H.**
Techniques de production et de contrôle des betteraves polyploïdes. **(Techniques for the production and verification of polyploid sugar beet).**
Ann. Inst. nat. Rech. agron., Paris : Sér. B. 1959 : **9** : 553–74.

Methods for the production of polyploids and investigations on their economic value are reviewed. After describing two staining techniques for chromosome-number determination, the author emphasizes the need for a rapid and simple method of determining the degree of ploidy of sugar-beet material at any stage of its life history. Various attempts to identify plant characters associated with the degree of ploidy are detailed, including the following: length of stomata, diameter of pollen grain, number of germinative pores in the pollen and number and distribution of nucleoli. The optimum method at present is the determination of the number of chloroplasts in stomatal guard cells [cf. XXVII, 2075 and XXIX, 2921] and a test is described which illustrates the direct proportionality of this number with the degree of ploidy. It is pointed out, however, that the method can not completely replace a direct determination of the chromosome number.

716 Butterfass, T.
Künstlich induzierte Pollensterilität bei Zuckerrüben. **(Artificially induced pollen sterility in sugar beets).**
Zucker, Hannover 1960 : **13** : 164–65.

The progeny from 93 diploid sugar beets sprayed twice with a 0·33% solution of sodium α,β-dichloroisobutyrate and grown in the vicinity of a red-leaved hybrid contained 70% of red plants compared with 35% from unsprayed plants.

717 Dudley, J. W.
Effects of sodium 2,3-dichloroisobutyrate, a selective gametocide, on sugar beets.
J. Amer. Soc. Sug. Beet Tech. 1960 : **11** : 25–36.

Preliminary greenhouse and field experiments were conducted in Colorado to determine the effectiveness of the above compound as a selective gametocide in sugar beets. The results indicated that the optimum concentration of the chemical in the field was ⅛%, applied at a carrier rate of 100 gallons per acre at the pollen-mother-cell stage. Such an application delayed pollen shedding by 7–10 days without seriously affecting seed yield or subsequent germination. Hypocotyl colour counts were made on the progeny of green-hypocotyl plants in the field experiment and these indicated that the three varieties used, A54–1, A54–6 and A54–7, had been cross pollinated. This suggests a method for the production of synthetic varieties. A similar study of the progeny of the two inbreds used in the greenhouse test, 52–407 and 54–565, revealed that the percentage of hybrids produced was 40·27% from plants treated three times with the gametocide and only 3·51% from the untreated controls. This indicates that chemical control of pollen formation offers an effective method of forcing certain self-fertile inbred lines of sugar beet to hybridize.

718 Lüdecke, H. & Nitzsche, M.
Zucker- und Natriumgehalt der Rübenwurzel als Kriterium der Sortenzugehörigkeit und des Reifegrades von Zuckerrüben. **(Sugar and sodium content of sugar-beet roots as a criterion of the variety to which they belong and the degree of maturity).**
Zucker, Hannover 1959 : **12** : 392–401.

Observations on a range of varieties in 1954–58 showed that in the middle of July the Na content was significantly greater in all E varieties than the mean of the N varieties, which in turn was significantly higher than that of the Z group. Differences in Na content between varieties with the same polarization value were found to correspond to differences in noxious nitrogen or other factors affecting quality. The Na contents gradually levelled out in the course of the season, the minimum being reached first in the Z group; it came some three weeks later in the N group, 10 days later still in the polyploids and latest of all in the E group. One variety which according to its root yield had been classified as an E type was shown by both sugar and Na contents to belong to the N group.

Parallel observations on K content showed no corresponding correlations.

The influence of various manurial and other factors on the Na and sugar contents was also studied and it was shown that Na content could be used as an index of the degree of maturity.

719 Barocka, K. H.
Die Variabilität des Fruchtmerkmals Mehrblütigkeit von *Beta vulgaris* L. **(The variability of the multigerm character of the flowers of *B. vulgaris* L.).**
Z. Pflanzenz. 1960 : **43** : 377–89.

The number of flowers per glomerule varied from 1 to 6 and over, both the mean and the highest number differing from plant to plant. The number of flowers in a cluster was not always correlated with its size. Though the mean number is affected by manuring, the maximum number per cluster was not increased by even the most favourable manuring. When clonal material was used the variation was much less, the number of flowers being characteristic of the clone and not affected by manuring. The mean number of flowers per glomerule was greater in plants in which the side shoots and the tip of the inflorescence had been removed, but there was still no difference in the maximum number; thus differences in the mean number are thought to result from variations in the number of side shoots.

The maximum number of flowers per cluster is usually found in the terminal cluster. Lateral clusters contained, under favourable conditions, one flower less than the terminal cluster, the primary flower being absent. The maximum number of flowers in the lateral clusters, plus one in respect of the primary flower, was therefore taken as an index of the maximum number per cluster and was found to be constant for different plants or clones. It is referred to as the maximum flower number. It remained constant in two lots of Kleinwanzleben E grown in separate localities differing in fertility. As against this, figures are given showing that in plants with identical maximum flower number the number of flowers per 100 clusters may vary considerably. It is therefore suggested that selection should be based on the maximum flower number, which has the further advantage that it can be assessed in the bud stage before flowering begins, thus ruling out the risk of out crossing.

720 **X-rays reveal seed properties of sugarbeets.**
Agric. Res., Wash. 1960 : **9** : No. **3** : p. 5.

An account is given of the application of an X-ray technique at the Michigan Agricultural Experiment Station as a means of detecting various seed defects, such as seedless and multigerm seed balls, which may arise in some unstable lines of monogerm varieties. The method may also prove useful in finding twin embryos as a source of monoploid breeding material.

721 VARŠAVSKIJ, B.
(Monogerm sugar beet).
Kolhoz. Proizvod. (Collect. Fm. Prod.) 1959 : No. **7** : 41–42. [Russian].

Nine institutes which have taken up the breeding of monogerm beets since 1957 are named. Seed productiveness and root and sugar yields of the existing monogerm varieties have been greatly improved at Belaja Cerkov', Jaltuškov and the Sugar Beet Institute in recent years.

722 OWEN, F. V., STOUT, M., MURPHY, A. M., SMITH, C. H. & RYSER, G. K.
Interaction of components of impurity and location in hybrids from inbred lines of sugar beets.
J. Amer. Soc. Sug. Beet Tech. 1960 : **11** : 37–43.

Twelve hybrids were produced by pollinating two male-sterile lines with six curly-top-resistant inbreds. Amongst the latter was CT9, whose hybrids have sometimes been exceptionally high in juice purity in certain areas. The hybrids were grown on a deep, silt loam at Twin Falls, Idaho, and on a saline, heavy loam at Salt Lake City, Utah. A significant interaction was observed between location and percentage purity of the different hybrids. The CT9 hybrids were highest in purity at the Idaho site, but were comparatively high in inorganic salts at the other site; they were however consistently low in amino nitrogen. On the other hand, CT7 hybrids proved to be consistently low in inorganic salt content but had a relatively high content of amino nitrogen. The need for a variety combining the favourable properties of both CT7 and CT9 is pointed out.

723 SAVARY, A.
Les nématodes de la betterave. II. Importance économique des dégâts causés aux cultures par *Ditylenchus dipsaci* Kühn, agent de la pourriture du collet, et essais de lutte. **(The beet nematodes. II. Economic importance of crop losses due to *D. dipsaci* Kühn, the causal agent of collar rot, and attempts to control it).**
Rev. rom. Agric. 1960 : **16** : 62–67.

Swiss trials of 21 sugar-beet varieties and 12 mangel varieties failed to reveal any possessing marked resistance to *D. dipsaci*.

724 FELTZ, H. & MARX, R.
Zur Mosaikresistenz bei Zuckerrüben. **(On mosaic resistance in sugar beets).**
Zucker, Hannover 1960 : **13** : 165–68.

Plants of 80 varieties of sugar beet from Europe and America, together with a number of breeding lines, were infected with a mixture of beet viruses 2 and 4 by means of *Myzus persicae*. All plants showed symptoms of yellowing in varying degrees and only a few were free from mosaic, several of these being F_1 hybrids. A number of mosaic-free plants were found in the progenies of the resistant plants, particularly in those from the varieties Sedlmayr Beta 242–53 and Kleinwanzleben CR. A natural hybrid with *Beta maritima* from the south-west coast of England was also resistant. Most of the mosaic-resistant progenies came from families possessing resistance to *Cercospora* and showing reduced infection with yellows and are thus considered to be valuable as breeding material.

725 RUSSELL, G. E.
Breeding for resistance to sugar beet yellows.
Brit. Sug. Beet Rev. 1960 : **28** : 163–70.

An account is given of (1) work carried out since 1953 at the Plant Breeding Institute, Cambridge, England, on breeding for yellows tolerance and (2) results of recent field trials in which the most advanced breeding lines were compared with commercial varieties under varying conditions of infection. The results suggest that promising material tolerant of both of the strains commonly occurring in Great Britain is now available for further breeding, the objectives of which are outlined.

726 JENNINGS, D. L.
Observations on virus diseases of cassava in resistant and susceptible varieties. II. Brown streak disease.
Emp. J. exp. Agric. 1960 : **28** : No. 111 : 261–70.

An account is given of brown-streak symptoms in varieties tested in Tanganyika. The material studied comprised back crosses of interspecific hybrids to cassava, intervarietal hybrids and native varieties. Resistant varieties tended to remain free from symptoms, and when these did appear, they were usually mild and restricted to the roots. Stem symptoms, when observed in resistant varieties, were often transient, recovery occurring in the second season's growth; hybrids involving *Manihot melanobasis* were however anomalous in this respect.

727 BURKILL, I. H.
The organography and the evolution of Dioscoreaceae, the family of the yams.
J. Linn. Soc. 1960 : **56** : 319–412.

An attempt is made to trace (1) the possible course by which the proto-Liliales gave rise to the Dioscoreaceae through the proto-Dioscoreaceae in the eastern hemisphere and (2) subsequent evolution within the Dioscoreaceae in both hemispheres. A key to the Old World sections of *Dioscorea* is included and relationships between these sections are discussed. Comments are made on various aspects of the evolution of the economically useful species of *Dioscorea*.

STIMULANTS

728 MICHE, A.
Le tabac à la Station de Mulungu-Tshibinda (Premiers résultats). [**Tobacco at the Mulungu-Tshibinda station. (First results)**].
Bull. INÉAC 1960 : **9** : 149–60.

A total of 165 varieties of all types were included in this trial; the control variety was Havana 211. Quality tests indicated that 11 varieties possessed high commercial value, but only two of these, Ehlers and Kimongo, outyielded the control.

729 URATA, U.
A cytogenetic study of the dwarf-variegated phenotype in *Nicotiana*.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–619 : p. 3481. (Abst.).

In certain F_2 and F_3 progenies of *N. langsdorffii* x *N. sanderae* dwarf plants appeared which had mottled leaves and spotted flowers, exhibited variable bud fall and were completely sterile. Segregation in the hybrid was extremely irregular and did not conform to any common ratios. The dwarf-variegated phenotype occurred only in lines in which a specific group of *N. sanderae* plants was used as parent. Trisomy was not related to this character.
While several types of dark : light and dark : white twin-spots occurred in normal and dwarf-variegated plants, these were infrequent in the former and very frequent in the latter. Flowers with twin spots always exhibited single spots of the types which comprised the twins; many of the dark single and twin spots were heavily mottled and it is concluded that some type of breakage-fusion bridge is responsible for this phenomenon since bridge formation is common in somatic divisions in dwarf-variegated plants. Cytological investigations showed sterility to be caused by asynapsis; chromosome fragmentation was frequently associated with asynapsis in the meiotic cells of dwarf-variegated plants. In mitosis a great increase in laggard formation, somatic micronuclei, polyploid cells and bridges was observed; the prophase-metaphase ratio was also altered, metaphases being more frequent in dwarf-variegated than in normal plants.
It is suggested that increase in spotting, increase in somatic cytological aberrations, change in prophase-metaphase ratio, and meiotic asynapsis and chromosome fragmentation in the dwarf-variegated plants may be due to the abnormal synthesis and accumulation of a chemical or chemicals capable of causing c-mitotic and radiomimetic effects.

730 KRISHNAMURTY, K. V., MURTY, G. S. & RAO, K. A.
Cytogenetics of the trispecific hybrid *Nicotiana tabacum* x (*N. glutinosa* x *N. trigonophylla*) and its reciprocal.
Euphytica, Wageningen 1960 : **9** : 111–21.

In reciprocal crosses of the amphidiploid *N.*

glutinosa x *N. trigonophylla* (G x Tr) with *N. tabacum* (Ta), the hybrids possessed mainly *N. tabacum* characters, but were intermediate in plant height and inflorescence and flower characters; the leaf shape of the pollen parent dominated. The hybrids were sterile, although both produced many flowers and (G x Tr) x Ta had a high set of parthenocarpic fruits. Germination has occurred only in a single seed of the back cross of Ta x (G x Tr) to *N. tabacum*. The modal bivalent frequency was 6·09 in Ta x (G x Tr) and 10·07 in (G x Tr) x Ta. The pairing behaviour is compared with that of other hybrid combinations.

731 Burk, L. G.
Male-sterile flower anomalies in interspecific tobacco hybrids.
J. Hered. 1960 : **51** : 27–31.

In the BC$_2$ generation of $4n$ (*Nicotiana bigelovii* x *N. tabacum*) to *N. tabacum*, approximately 70% of the population possessed flattened, petaloid anthers, while some also had split corollas. Similar anomalies were observed in the BC$_3$ and BC$_2$S$_2$ generations derived from this cross.

Petaloid-stigmatoid anthers, preventing proper pollen development, were also noted in a single plant of an otherwise normal BC$_2$ generation of [(*N. tabacum* x *N. plumbaginifolia*) x *N. tabacum*] x *N. tabacum*. Similarly modified florets occurred in a single plant of the F$_1$ generation of *N. tabacum* x *N. glutinosa*. In the latter two cases, the cytoplasm of the hybrids is derived from *N. tabacum*. In order to restore the chromosome complement of *N. tabacum* to its cytoplasm, the two male-sterile plants were repeatedly back crossed with that species. This process continued for seven generations; every plant from each generation showed male sterility, with one single exception. The resulting male-sterile tobacco ($2n = 48$) plants were then hybridized with *N. plumbaginifolia*, *N. glutinosa*, *N. tomentosiformis* and *N. otophora*. Mature interspecific hybrids were obtained in all crosses except those with *N. plumbaginifolia*, and were normal in all respects except that they too developed stamen modifications.

732 Ternovskij, M. F. & Terent'eva, A. I.
(The role of grafting in improving crossability between *Nicotiana* species).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **132** : 932–35. [Russian].

The effects of vegetative rapprochement on crossability between (1) *N. tabacum* ($2n = 48$) and *N. alata* ($2n = 18$) and (2) *N. rustica* ($2n = 24$) and *N. glauca* ($2n = 12$) were studied at Krasnodar. Contrary to expectation, vegetative rapprochement reduced the crossability of the species in case (1). This is attributed to the use of scions too old to be influenced by the stock. Differences were observed in the ease with which own-rooted tobacco cultivars crossed with *N. alata*. Hercegovina 395, Havana 1415, Gold Leaf 1814 and Burley 2293 were among those which crossed readily.

In (2), the combination *N. rustica* ♀/*N. glauca* x *N. glauca* ♂, resulted in improved crossability. The resultant F$_1$ comprised plants with one genome of *N. rustica* and one of *N. glauca* or one genome of *N. rustica* and two genomes of *N. glauca*.

In the F$_1$ generation two haploid plants of *N. rustica* with $n = 24$ appeared. They showed the usual meiotic irregularities and occasionally cells with the unreduced chromosome number occurred, giving rise to 9–12% of fertile pollen. Capsules were formed but contained no seeds.

733 Anders, F. & Vester, F.
Genetisch bedingte Tumoren und der Gehalt an freien Aminosäuren bei *Nicotiana*. **(Genetically conditioned tumours and the content of free aminoacids in *Nicotiana*).**
Experientia 1960 : **16** : 65–67.

Analyses of *N. glauca* and *N. langsdorffii* showed the latter to contain slightly more protein-free ninhydrin-positive substances than the former; the amphidiploid hybrid between them was higher still, the relative proportions being 1 : 1·24 : 1·62; the hybrid had considerably more cystine, histamine, oxyproline, alanine, kynurenine and tryptophane, as well as a ninhydrin-positive compound not yet identified. The high content of free aminoacids may, it is thought, be connected with the tumour formation characteristic of this hybrid, particularly in view of the fact that tryptophane is associated with gall formation in *Vitis* and other organisms whereas it is absent in both parental species of the hybrid.

734 Sand, S. A., Sparrow, A. H. & Smith, H. H.
Chronic gamma irradiation effects on the mutable V and stable R loci in a clone of Nicotiana.
Genetics 1960 : **45** : 289–308.

Investigations which have already been briefly reported are described in full [cf. XXX, 1834].

735 **NC 75 tobacco resists disease.**
Crops & Soils 1960 : **12** : No. 8 : 22–23.

This new high-yielding, disease-resistant tobacco was developed from crosses involving Dixie Bright 102, Bottom Special and Beltsville 1–76. It is moderately resistant to black shank and *Fusarium* wilt, highly resistant to black root rot and shows less injury from brown spot than some leading varieties. Some resistance to Granville wilt has been observed in field tests. Its leaf characteristics are satisfactory.

736 **Burley 37 is new disease-resistant tobacco variety.**
Crops & Soils 1960 : **12** : No. 9 : p. 25.

Burley 37, which has been released by the USDA and the Tennessee Agricultural Experiment Station, is resistant to both black shank and wild fire. It has performed well in yield trials in several states. Unlike Burley 11A and 11B, it has an upright growth habit and this leads to less leaf breakage and thus a higher-quality leaf.

737 NETTANCOURT, D. DE & STOKES, G. W.
Haploidy in tobacco.
J. Hered. 1960 : **51** : 102–04.

In 104,000 germinated seeds from self pollination of 12 tobacco varieties, 9 twin embryos were found of which 10 seedlings died; of the remainder one individual (from variety Ky.151) was haploid. A technique based on the use of a recessive character, in this case susceptibility to tobacco mosaic virus, as a seedling marker, was used to screen 2500 seedlings resulting from a susceptible (Ky.16) x hypersensitive (Ky.35) cross. All plants resulting from fertilization by Ky.35 were hypersensitive and did not survive TMV inoculation, while those arising as a result of female pollen contamination or female haploid parthenogenesis were mosaic susceptible and survived. One of two surviving plants was haploid.

In the haploids, guard-cell length, corolla diameter, filament length and anther and pollen-grain size were approximately two-thirds normal and flowering was slightly earlier than in normal plants. In meiosis the number of chromosome units (bivalents + univalents) ranged from 19 to 22 at metaphase I, suggesting a pairing range of two to five bivalents. Chromosome numbers ranged from 14 to 22 at metaphase II, indicating that some of the univalents divided equationally at metaphase I.

In a series of crosses involving haploid and diploid parents, no seed was set when the haploid was used as the pollen parent. Of 8 seedlings produced from haploid ♀ x diploid ♂ crosses, 4 were sterile and 4 set an abundance of viable seed on selfing; differences in fertility are thought to indicate differences in female gamete chromosome numbers.

738 MANN, T. J., MATZINGER, D. F. & WEYBREW, J. A.
Nicotine and sugar contents of mammoth flue-cured tobacco varieties.
Agron. J. 1960 : **52** : 350–52.

The four standard day-neutral varieties Dixie Bright 101, Dixie Bright 102, Virginia Gold and 402 and short-day mammoth counterparts of these varieties developed by back crossing were grown for comparative evaluation at the Border Belt Tobacco Research Station, Whiteville, NC. All mammoth selections gave higher yields of cured leaf than their respective recurrent parents, this increase being attributable to the additional leaves which remained on the plants after harvesting of the varieties was over. The mammoth selections were in most cases inferior to their respective recurrent parents in value per cwt., nicotine yield per acre and percentage of nicotine and reducing sugars in the cured leaves but superior in yield of reducing sugars. Additional experiments were designed to determine the influence of leaf position from data on weekly harvests. The nicotine contents of the leaves of the last four harvests from the mammoth selections were much lower than those of leaves having comparable stalk positions on the standard varieties and were possibly too low to be commercially acceptable. No significant differences were detected in content of reducing sugars between the varieties and their mammoth counterparts for any particular harvest. The low nicotine content of the mammoth selection is ascribed to the effect of competition for nitrogen, brought about by prolonged vegetative growth.

739 PATEL, G. J.
Estimates of genotypic and phenotypic variances and covariances in a high and a low yielding population of flue-cured tobacco and their implications in selection.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–4692 : 1549–50. (Abst.).

The material studied consisted of 60 random F_3 lines, three from each of the ten F_2 families in each of the populations (1) BS x C139 (high yielding) and (2) 402 x Hicks (low yielding). The genetic model used involved additive action and dominance but no epistasis or linkage. In (1) the mean performance of the parents and relative magnitude of dominance variance to additive suggested nonadditive or dominant action for cured leaf yield and quality. In (2), however, gene action was additive. It thus appeared that no single breeding procedure may be considered as effective for flue-cured tobacco. Cyclic procedures of (*a*) selection and interbreeding of superior genotypes and (*b*) selection, inbreeding, testing and interbreeding the superior genotypes to combine favourable dominant genes would be efficient for (2) and (1) respectively. In general, plant-type features had higher heritability than yield and quality characters. Green weight of leaf had higher heritability than cured leaf yield. Plant height was highly correlated with cured leaf yield and appeared to be a better criterion in selection for leaf yield than flowering time and leaf number. The high correlation between green and cured weight of leaf would make it possible to adopt the former weight as a selection criterion, although its use would entail loss in information on quality. The drawback may be overcome by curing an adequate sample and obtaining data on the component characters determining leaf quality.

740 SCHIPFER, L.
Wie weit sind unsere Tabaksorten kältefest? (**How far are our tobacco varieties resistant to cold ?**)
Tabakpfl. Öst. 1958–1959 : **10** : 9–11.

All the six varieties tested withstood temperatures of — 2·5° C, when they had been hardened off before planting out and when the frost did not occur immediately after planting out. At — 4·4° C almost all the plants were damaged but varieties differed in the percentage of plants destroyed.

741 WARK, D. C., HILL, A. V., MANDRYK, M. & CRUICKSHANK, A. A. M.
Differentiation in *Peronospora tabacina* Adam.
Nature, Lond. 1960 : **187** : 710–11.

At least three strains of the above pathogen have been identified in Australia, differing in range of pathogenicity on *Nicotiana* spp., symptoms and reproductive capacity. The disparities in pathogenicity may be of significance in breeding resistant tobacco varieties.

742 MOORE, E. L., POWELL, N. T. & GWYNN, G. R.
Search for root-knot and black-shank resistance.
Res. & Fmg. 1960 : **18** : p. 3.

As the result of a cooperative project between the North Carolina Agricultural Experiment Station and USDA Crops Research Division, two families of breeding lines highly resistant to root-knot nematode and black shank have been developed. They have also shown some resistance to *Fusarium* and Granville wilts and brown spot. Hicks Broadleaf entered into the parentage of one family and 5346 [cf. XXIX, 4238] into that of the other. Information is provided on the yield, plant characters and quality of three lines.

743 GRAHAM, T. W.
A root-knot-resistant tobacco breeding line released to breeders.
Phytopathology 1960 : **50** : 575–76. (Abst.).

PD611, a new flue-cured tobacco breeding line, has a stabilized high level of resistance to *Meloidogyne incognita acrita*. It has satisfactory growth, yield and curability characteristics, although the cured leaf is below top quality and is not acceptable to some manufacturers. The origin of the new strain is outlined.

744 TUTEL, B.
Quelques recherches morphologiques, anatomiques et physiologiques sur le *Nicotiana tabacum* L. de Malatya et de Bursa du point de vue de leur résistance contre *Thrips tabaci* Lind. (**Some morphological, anatomical and physiological investigations on varieties Malatya and Bursa of *N. tabacum* L., with reference to their resistance to *Th. tabaci* Lind).**
Rev. Fac. Sci. Univ. Instanbul : Sér. B. 1959 : **24** : 171–223.

Malatya tobacco is generally more resistant than Bursa to *Th. tabaci*. This detailed study has investigated differences between the two varieties and indicates that these differences, together with environmental factors, determine relative resistance to the disease.

745 HOLMES, F. O.
Attainment of an improved level of resistance to infection by tobacco mosaic in tobacco.
Phytopathology 1960 : **50** : p. 572. (Abst.).

In new breeding lines, derived from crosses between TI 245 and other types of tobacco, an improved degree of resistance to mosaic has been obtained.

746 Gerstel, D. U. & Burk, L. G.
Controlled introgression in *Nicotiana*: a cytological study.
Tobacco Sci. 1960 : **4** : 147–50.

Resistance to tobacco mosaic virus was incorporated from *N. glutinosa* into Holmes Samsoun (HS) and Burley 21 (B21) several years ago. It also exists in Ky151, a variety developed in Kentucky from HS. A cytological study of crosses between these varieties and two non-resistant tobacco varieties, Red Russian (RR) and Ky16, has been carried out to elucidate the problem of the length of the *N. glutinosa* chromosome segments in the resistant varieties. During meiotic metaphase, the chromosome carrying resistance in B21 usually paired with the pure *N. tabacum* chromosome of Ky16, since almost all cells had 24 bivalents. On the other hand, in the RR x HS hybrid the resistance-carrying chromosome in HS failed almost completely to pair with its counterpart in RR.

In the hybrid B21 x HS some cells showed 24_{I} while a majority had $23_{\mathrm{II}} + 2_{\mathrm{I}}$; there was also some evidence of additional asynapsis in the form of some cells with $22_{\mathrm{II}} + 4_{\mathrm{I}}$.

These results indicate that the resistance-carrying chromosome of B21 contains a segment from *N. glutinosa* of sufficient length to permit frequent formation of chiasmata when crossed with HS; the evidence regarding the latter variety supports the conclusion that the resistance factor in this variety is contained in an entire *N. glutinosa* chromosome.

In the pollen mother cells of B21 x HS the univalents had a tendency to lie side by side, rather than in random positions. To a lesser extent, similar behaviour was observed in the HS x RR hybrid, in spite of the evidence that the two chromosomes involved were derived from *N. glutinosa* and *N. tabacum* respectively. A pair of univalents, from *N. tabacum* and *N. plumbaginifolia*, were found to occupy random positions in a study made for comparative purposes. Evidence is presented which suggests that the univalents in the B21 x HS and HS x RR crosses were lying together because they had been conjugated, or associated, during prophase [cf. XXV, 1861]. The large number of chromosomes in tobacco hinders cytological confirmation of this suggestion.

747 Aach, H. G.
A difference between the sub-units of tobacco mosaic virus protein?
Nature, Lond. 1960 : **187** : 75–76.

Analysis of new preparations of strains of the above virus, which may be considered to be as uniform as is experimentally possible, confirmed the changes in aminoacid composition previously found to be associated with mutation from *vulgare* to *flavum* and from *flavum* to *necans* [cf. XXIX, 4245]. In addition, a significant difference was detected in the phenylalanine content between *vulgare* and *flavum*, corresponding to 0·5 aminoacid residues per protein subunit.

748 Wittmann, H. G.
Vergleich der Proteine des Normalstamms und einer Nitritmutante des Tabakmosaikvirus. **(Comparison of the proteins of tobacco mosaic virus and of a nitrite mutant).**
Z. VererbLehre 1959 : **90** : 463–75.

The *Ni*54 mutant produced by Mundry and Gierer [cf. XXIX, 1206, 2214] was multiplied in *Nicotiana tabacum* 'Samsun', isolated and separated into its protein and RNA components; the aminoacids of the protein moiety were then analysed by the automatic chromatographic apparatus. The protein from the normal strain, prepared in a similar manner, was also analysed and the results are compared with those of other investigators. No differences could be detected between the normal strain and the mutant.

749 Tsugita, A. & Fraenkel-Conrat, H.
The amino acid composition and C-terminal sequence of a chemically evoked mutant of TMV.
Proc. Nat. Acad. Sci. USA 1960 : **46** : 636–42.

The protein of a mutant which was isolated after nitrous-acid treatment and reconstitution of the RNA of tobacco mosaic virus (TMV) differed from that of the parent virus in that three aminoacid residues (proline, aspartic acid and threonine) were replaced by three others (leucine, alanine and serine). The mutant was detected by its production of only local lesions on *Nicotiana sylvestris* and Java and of a mosaic disease on Turkish milder than that due to common TMV. The action of carboxypeptidase on the mutant led to extensive digestion, indicating that one of the changes, viz. replacement of proline by leucine, occurred near the C-terminus of the peptide chain. The implication of the finding that one chemically induced mutant may differ in protein composition from the parent strain while, as reported by Wittmann, another may not is of interest in connexion with the mode of coding of genetic properties by RNA.

750 BARUA, D. N. & DEB, S. B.
Variation in the nitrogen content of tea leaves.
J. Sci. Fd. Agric. 1960 : **11** : 366–70.

An analysis was made of the variability in total N content in different clones at various stages of development and under diverse conditions of growth. A standardized technique of sampling for comparison of clones and other experiments is suggested.

751 CARVALHO, A.
Coffee genetics and breeding.
Inst. Agron., Campinas, undated : Pp. 13.

In this general survey, attention is drawn to the techniques adopted and problems studied at the Agronomic Institute in São Paulo, Brazil. Extensive details are given of the genes known to affect such features as seedling characters, plant branching, growth and development, and leaf, flower and fruit characteristics.

Over a 6-year period, individual yields have been taken from 80,000 coffee plants grown in each of six experiment stations. The plants belonged to the *typica*, *xanthocarpa*, *semperflorens*, Maragogipe, Cera, Bourbon, Caturra, Yellow Bourbon and Mundo Novo varieties. The highest yielding plants were found to belong to the last three varieties.

Artificial hybridization among selected plants of the best coffee progenies has yielded two promising types which are still under observation. One, a Yellow-Mundo Novo type, occurred in a F$_2$ from a cross between selected plants of Yellow Bourbon and Mundo Novo. The other, a Yellow-Caturra-Mundo Novo type, appeared in an F$_2$ from a cross between Yellow Caturra and Mundo Novo plants. These new types may be used for the establishment of new coffee plantations in the near future.

752 CARVALHO, A.
Genética de *Coffea*. XXIV. Mutantes de *Coffea arabica* procedentes da Etiópia. (**Genetics of *Coffea*. XXIV. Mutants of *C. arabica* from Ethiopia**).
Bragantia 1959 : **18** : 353–71.

A small sample of seedlings raised from coffee collected in Ethiopia and forwarded via the US Department of Agriculture proved to be highly heterogeneous. The following genes were identified. Eritrean Moca is homozygous for the *semperflorens* gene, *sf*. Many plants carried the *tt* alleles characteristic of Bourbon; this gene was previously thought to have arisen in Réunion. *Typica* plants, *TNa*, also occur in Ethiopia. Other genetic characters identified included *abyssinica*, *br* for leaf colour, a new character *semierecta*, *se*, *macrocarpa*, and small folicaceous and persistent sepals not determined by *sd*. [Cf. XXIX, 573].

753 CARVALHO, A.
Informe preliminar sobre la genética de los cafés etiopes. (**Preliminary report on the genetics of Ethiopian coffees**).
Café, Turrialba 1960 : **1** : No. 4 : 5–6.

This is a Spanish translation of a paper already summarized [XXIX, 2941].

754 CARVALHO, A. & MÔNACO, L. C.
Híbridos entre *Coffea* e *Psilanthopsis*. (**Hybrids between *Coffea* and *Psilanthopsis***).
Bragantia 1959 : **18** : XXI–XXIX.

Hybrids have been raised in Brazil from the crosses *C. arabica* x *C. kapakata*, *C. canephora* x *C. kapakata*, and *C. eugenioides* x *C. kapakata*. A few fruits set in the cross *C. dewevrei* x *C. kapakata* but no seedlings were obtained. Data are provided on the inheritance of pigmentation in these crosses. In view of the ease with which hybrids were obtained between *C. kapakata* and *Coffea* spp., Chevalier's transfer of *C. kapakata* to the monotypic genus *Psilanthopsis* is opposed.

755 CARVALHO, A. & ANTUNES FILHO, H.
Melhoramento do cafeeiro. XVI. Efeito da autofecundação sucessiva no café Bourbon. (**Improvement of coffee. XVI. The effect of successive selfing in Bourbon coffee**).
Bragantia 1959 : **18** : 343–51.

Comparative trials of S_1, S_2, S_3 and S_4 progenies and F_1 hybrids between S_0, S_2 and S_4 plants in São Paulo, Brazil, revealed little effect of selfing on yield. The F_1 hybrid yield variances were slightly and not significantly higher than those of the selfed progenies [cf. 756].

756 CARVALHO, A., MÔNACO, L. C. & ANTUNES FILHO, H.
Melhoramento do cafeeiro. XV. Variabilidade observada em progênies de café. (**Improvement of coffee. XV. The variability observed in coffee progenies**).
Bragantia 1959 : **18** : 373–86.

A comparative study of S_1 and S_2 progenies of Bourbon coffee and F_1 and F_2 progenies of crosses between selected trees has been made at Campinas, Brazil, selection being practised in the S_1 and F_1 for low, medium and high yield. Neither selfing nor selection appeared to have much effect on yield, the variation in this character being apparently mainly caused by the environment [cf. 755].

757 Carvalho, A.
A energia nuclear e o cafeeiro. (**Nuclear energy and the coffee tree**).
Bol. Suptda. Serv. Café S. Paulo 1959 : **34** : No. 394 : 5–6.

The origin of the Brazilian coffee 'Nacional' [National] is traced to a single plant obtained from seed brought initially by the Dutch from Arabia and in studies over the last 25 years on *Coffea arabica*, segregation has been found in only 40 genetic factors. Seeds of Nacional and Bourbon have been subjected to doses of up to 25 r. of X rays and the progenies are being studied for the presence of useful mutants. Reference is made to experiments with Co^{60} made for a similar purpose in Costa Rica [cf. XXX, 657].

758 Dublin, P.
Biologie florale du *Coffea dewevrei* de Wild race *excelsa* A. Chevalier. Troisième partie. Floraison, pollinisation, fécondation. (**Floral biology of *C. dewevrei* de Wild race *excelsa* A. Chevalier. III. Flowering, pollination and fertilization**).
Agron. Trop., Nogent 1960 : **15** : 189–212.

In the third part of this study [cf. XXX, 658], details are presented of variations in flower morphology and of different forms of floral atrophy which occur. There is a tendency to form a significant proportion of virescent flowers, a characteristic which appears to be hereditary. Although the species never flowers during the interseason period, the time of flowering in the Central African Republic varies according to local conditions, being correlated with rainfall. Environmental conditions also influence the rhythm of flowering of the individual tree. There is a 3–4 day period after the flowers have opened during which the stigmata retain their sensitivity. The percentage seed set obtained after self fertilization was from 0·8 to 11·6%.

759 Medina, D. M. & Mendes Conagin, C. H. T.
Auto-incompatibilidade em *Coffea Dewevrei* de Wild. et Th. Dur. (**Self incompatibility in *C. Dewevrei* de Wild. et Th. Dur.**).
Bragantia 1959 : **18** : 283–93.

Varieties Abeokutae, Dybowskii, Excelsa and Dewevrei of the above species are self sterile and only cross compatible between certain plants. Incompatibility appears to be genetically determined.

760 Castillo Z., J.
Observaciones sobre tamaño de grano y granos anormales en variedades comerciales de café. (**Observations on grain size and abnormal beans in commercial varieties of coffee**).
Cenicafé, Chinchiná 1959 : **10** : 397–418.

A detailed study of variations in bean size and of the relationship of this factor to quality has been carried out in Colombia on the following six varieties of *Coffea arabica*: Caturra amarillo [Yellow Caturra], Caturra rojo [Red Caturra], Mundo Novo B and T, Típica amarillo [Yellow Typical], and Borbón amarillo [Yellow Bourbon]. The highest percentages of empty and abnormal beans were found in the Mundo Novo varieties but did not appear to be numerous enough to be of economic importance.

761 Narasimhaswamy, R. L.
Arabica selection S.795—its origin and performance—a study.
Indian Coff. 1960 : **24** : 197–204.

An account is given of the breeding, characteristics and performance of S795 (S288 x Kents), a cultivar developed at the Balehonnur Coffee Research Station, India, and now occupying 25–30% of the acreage of *arabica* coffee in India. It is highly resistant to the common races of leaf disease (*Hemileia vastatrix*) affecting Coorgs and Kents. Further selection of S795 now in progress has increased the degree of resistance and reduced the occurrence of polyembryony. The variety has been used as a parent in crossing.

762 Reunión sobre la herrumbre y algunos otros problemas patológicos del café celebrada en Costa Rica del 25 al 27 de Noviembre 1959 y auspicida por el Instituto Interamericano Ciencias Agrícolas. (**Conference on rust and some other pathological problems of coffee, held in Costa Rica from 25 to 27 November, 1959, under the auspices of the Interamerican Institute of Agricultural Sciences**).
Café, Turrialba 1960 : **1** : No. 4 : 6–14.

At the above conference, B. d'Oliveira surveyed breeding for rust resistance in coffee throughout the world and went on to describe Portuguese work already reported elsewhere [XXX, 2999]. In addition, he mentioned that only one coffee with the *arabica* phenotype has proved resistant to all races of *Hemileia vastatrix.* Resistant plants have also been found in *Coffea abeokutae, C. congensis, C. canephora, C. eugenioides, C. dibowskii, C. liberica* and *C. stenophylla.* In the discussion following his paper the same speaker listed four groups of clones showing resistance to different rust races.

763 Hanger, B. F. & Firman, I. D.
Resistant varieties of coffee in relation to physiologic races of *Hemileia vastatrix* in Kenya.
Kenya Frmr. 1960 : **25** : 210–11.

Information is provided on the occurrence of races I, II and VII in Kenya and on varietal resistance and immunity to the first two of these races.

764 Rayner, R. W.
Rust disease of coffee. 3. Resistance.
World Crops 1960 : **12** : 261–64.

This account of methods used at the Coffee Rust Research Institute at Oeiras, Portugal, includes a general description of the nine groups into which the cultivated coffee varieties have been classified on the basis of their reaction to the ten known races of *Hemileia vastatrix* [cf. XXX, 2999].

765 Nutman, F. J. & Roberts, F. M.
Investigations on a disease of *Coffea arabica* caused by a form of *Colletotrichum coffeanum* Noack. I. Some factors affecting infection by the pathogen.
Trans. Brit. mycol. Soc. 1960 : **43** : 489–505.

Conidia from different sources were found to vary in viability and infectivity, those on lesions from ripe berries being superior in these respects to those from green. Different stages of the crop varied markedly in susceptibility, flowers, very young fruit and ripe berries being most susceptible. Tests of resistant and susceptible varieties showed wounding to increase susceptibility in all varieties. Varietal differences are attributed to physical or chemical differences in the cuticle.

VI Reunião do Comité Técnico Interamericano de Cacau. **(VIth Inter-american Conference on Cacao).**
Bahia 1956 : Pp. 471.

766 *Ostendorf, F. W. Identifying characters for cacao clones.* (*pp. 89–116*).

Biometrical and other characters of value in distinguishing cacao clones are discussed.

767 *Bartley, B. G. Methods of breeding and seed production in cacao.* (*pp. 169–75*).

The relative value of inbreeding, controlled single crosses, polycrosses and synthetic varieties in cacao breeding and seed production is briefly discussed.

768 *Bartley, B. G. Single plant selection in cacao improvement.* (*pp. 177–83*).

The following topics are discussed: estimation of environmental variance by interplanting clones and segregating populations; hybridization of selected clones; and the planning of varietal trials.

769 *Erickson, A. L. Comparison of yields —cuttings versus seedlings from selected clones.* (*pp. 185–91*).

Marked superiority in wet weight of beans of clonal cuttings in comparison with clonal seedlings was noted in trials at Turrialba.

770 *Montserin, B. G. & Verteuil, L. L. de. Hybridization work of the Department of Agriculture (Trinidad and Tobago) for the control of witches' broom disease of cacao.* (*pp. 203–11*).

The history of the Trinidad programme for breeding cacao for resistance to *Marasmius perniciosus* is recounted. Trinitario selections have been crossed with the immune seedling SCA6 of Ecuadorian origin and with other resistant forms and the best of the hybrids are now being back crossed.

771 *Pinto, G. C. P. & Magalhães, W. dos S. Três anos de seleção nos cacauais da Bahia. (Three years of selection with the cacao trees of Bahia.* (*pp. 213–15*).

Preliminary work on the selection of Amazonian cacao at the Instituto Agronômico do Leste, Bahia, Brazil, is reported.

772 Bridgland, L. A.
Cacao improvement programme, Keravat.
Papua New Guinea agric. J. 1960 : **12** : 149–67.

Progeny trials have indicated that great variability exists in New Guinea cacao and that the crop is capable of radical improvement in several respects such as earliness of bearing, yielding ability, resistance to black pod disease, and bean size, flavour and cocoa butter content. Some 60 trees have now been selected and are being used for the development of clonal seed, for direct clonal propagation by means of rooted cuttings and for hybrid seed development.

Techniques used in these three programmes, as well as in selection, are described in detail.

773 GLENDINNING, D. R.
Selfing on self-incompatible cocoa.
Nature, Lond. 1960 : **187** : p. 170.

At the West African Cocoa Research Institute, an attempt was made to self a self-incompatible clone (Nanay 32) of Upper Amazon cocoa by applying pollen from a tree compatible with it, together with a little pollen from the clone itself. The tree used to provide the compatible pollen was homozygous for the marker gene for axil spot in the seedling. One pod was obtained which gave 46 seedlings with the axil spot and 4 without it. These four seedlings are assumed to be selfs. Based on the incompatibility system proposed by Cope [cf. XXVIII, 3274], the theory behind this experiment was as follows. If the proportion of ovules in which the same dominant alleles were combined is sufficiently low, the flower may remain on the tree and selfed ovules, in which different alleles or alleles recessive to others present have come together, are able to develop into seeds. According to the terminology of Knight and Rogers [cf. XXV, 3318], Nanay 32 carries alleles 2 and 4, 2 being dominant to 4. The four seedlings will thus be 2·4 or 4·4, any ovules which were 2·2 having failed.

774 SORIA V., J.
Notes on the variability of cacao tipes in some Nicaraguan plantations and comments on their genetic constitution.
Cacao, Turrialba 1959 : **4** : No. 2 : 1–2.

Observations on cacao populations in Nicaragua have indicated that cultivated cacaos form only one highly variable species with four principal varieties, Pentagona, Criollo, Calabacillo and Forastero. The latter is a hybrid complex between Criollo and Calabacillo. Pentagona appears to be one of the extremes in variability of the complex of types forming *Theobroma cacao*; it is suggested that this variety may be of great value in breeding work because of the high degree of hybrid vigour to be expected in crosses between it and other cacaos of different genetic origin.

775 MALAGUTI, G.
Primeras observaciones sobre la "buba" o "agallas" del cacao en Venezuela. (**Preliminary observations on cushion gall of cacao in Venezuela**).
Agron. trop., Venezuela 1958 : **8** : 115–20.

Observations on cushion gall in certain interspecific hybrids of cacao suggest that the occurrence of the tumours may be genetically controlled, as in interspecific crosses of *Nicotiana* [cf. XXIV, 2305].

776 TURNER, P. D.
Distribution of strains of *Phytophthora palmivora* from *Theobroma cacao* in West Africa.
FAO Plant Prot. Bull. 1960 : **8** : 53–4.

One hundred and seventy-nine isolates from ten West African countries were examined. With the exception of two atypical isolates from Sierra Leone, all isolates from countries west of Dahomey were of the "cacao" type; very occasionally isolates of this group were also found in Nigeria and Southern Cameroons. Isolates from Nigeria, Southern Cameroons, Fernando Po and Cameroon were characteristically of the "rubber" group. Isolates from Gabon were of both groups, and single isolates from the Belgian Congo and Angola were of the "cacao" and atypical categories respectively.

Oospores were formed in abundance in "cacao" x "rubber" crosses, and occasional oospores were also found in mixed cultures of the "rubber" group.

777 SCHIJFSMA, L., HOESBERGEN, M. & NIJDAM, F. E.
A study of the colour and other characters of the seed of some varieties of oil seed poppy.
Euphytica, Wageningen 1960 : **9** : 127–40.

In studies of seed shade and colour, Emmabloem [Emma Flower] and Nobel were true breeding for blue seeds and did not respond to selection for shade, while others showed variation in both colour and shade and responded to selection for both characters. Shade was highly correlated with the calcium oxalate content of the seed coat. Nobel and Emmabloem had highly ridged seed coats, but other varieties varied with respect to this character.

Annual Report of the Department of Hop Research, Wye College 1958 (1959) : Pp. 90.

778 *Neve, R. A. & Farrar, R. F. Plant breeding section. Review of the year's work. (pp. 10–14).*

In breeding hops tolerant of wilt (*Verticillium albo-atrum*), the most advanced material consists of three varieties being propagated for farm trials. Among the seedlings representing less advanced stages in the project are triploids of Bullion, Fuggle and Goldings.

In response to the demand for hops for lager brewing, $2x$ and $4x$ Hallertau and $2x$ Saaz were crossed with wilt-tolerant males.

To meet the demand for improved wilt-susceptible varieties from growers outside the wilt-infested area, susceptible but otherwise promising seedlings will not be discarded in the first-mentioned project. Also with a view to developing varieties specifically for wilt-free districts, use of males more likely to transmit good brewing characteristics than the wilt-tolerant males at present available has been initiated. Seedlings from Fuggle N x 169 were planted out. A German male (T47) was used to pollinate $4x$ forms of Eastwell Golding, Early Bird and Hallertau.

Three varieties from Germany are serving as sources of resistance to downy mildew (*Pseudoperonospora humuli*). Seedlings from crosses of these varieties and wilt-tolerant males were inoculated with *P. humuli* in the four-leaf stage; seedlings surviving a similar test in 1957 were further tested by leaf and bud inoculation in 1958; three ♂ seedlings showing some resistance were chosen for use in further breeding.

Bullion triploids were machine-picked with encouraging results.

Colchicine treatment of six Saaz varieties and Mathon was initiated.

Recording of seedling families confirmed that the proportion of ♂ seedlings depends upon the amount of pollen applied when pollinating and use was made of this finding in hybridization; since $3x$ males are sterile it is desirable to keep the number of males in $3x$ families as low as possible.

779 *Beard, F. H. Notes on unnamed Wye varieties of hops in commercial cultivation. (pp. 32–39).*

Information is given on the plant characteristics, yield, disease reactions, brewing qualities and other features of the following: AGG8 (seedling of Brewer's Gold); OF27 (derivative of a German variety from Hersbruck crossed with an English male); ON78 (third-generation seedling from Oregon Cluster) and DD12 (from Bramling x *Humulus americanus* var. *neomexicanus* 'R4/25a').

Annual Report of the Department of Hop Research, Wye College 1959 (1960) : Pp. 154.

780 *Burgess, A. H. & Glasscock, H. H. Professor E. S. Salmon. (pp. 1–6).*

An obituary account is given of the work of E. S. Salmon on hop pathology and breeding.

781 *Neve, R. A. & Farrar, R. F. Plant breeding section. Review of the year's work. (pp. 15–17).*

The three varieties selected from the Wye-East Malling joint scheme as potential wilt-tolerant replacements of Fuggle were distributed for trial by growers in comparison with Whitbread's Golding [cf. 778–9]. A wilt-susceptible $3x$ seedling of Bullion was released for farm trial in the western midland region. In addition, three wilt-tolerant varieties of the American type are to undergo a single trial under commercial conditions.

A seedling with a sufficiently high degree of resistance to downy mildew for breeding purposes was used in crosses with $2x$ and $4x$ Nonsuch (OB53), a variety highly tolerant of wilt and having a very high resin content. The chief aim of this hybridization is production of ♂ seedlings capable of transmitting wilt tolerance, downy-mildew resistance and high resins content.

In further breeding for wilt tolerance, $2x$ and $3x$ seedlings from Golding, Hallertau and Saaz hops, pollinated by tolerant males, were planted out.

Wilt-tolerant Whitbread's Golding and ♂ OB79 were treated with colchicine to obtain wilt tolerant $4x$ males for production of $3x$ seedlings. Diploids from Eastwell Golding x OB79 were less susceptible to wilt than triploids from $4x$ Eastwell Golding x OB79. Resin analyses of $2x$ and $3x$ seedlings from the same crosses confirmed earlier indications that ♂ OB79 transmits the character high resin content.

782 *Coley-Smith, J. R. Testing hop varieties for resistance to downy mildew disease* Pseudoperonospora humuli *(Miy. and Tak.) Wilson. I. Preliminary detached leaf and shoot tests. (pp. 40–47).*

Information is given on detached-leaf tests and tests of the shoots of pot plants which have been used for a preliminary evaluation of varietal reaction to downy mildew.

783 *Farrar, R. F. The seed content of triploid hops. (pp. 115–19).*

This paper was contributed to the Wye College Hop Conference held in January 1960. Study of $2x$ and $3x$ plants of Bullion and Fuggle N indicated that the triploids, while not seedless, had a much reduced seed content compared with the diploids. Some commercial aspects of this finding are discussed.

784 **Hop Research. Annual Report of the Co-operative Research of the Hop Research Station, DSIR, and the Cawthron Institute for 1958-59** : undated : unpaginated.

Three new varieties tolerant of root rot (*Phytophthora miyabeanus*) are to be distributed for trial by growers in New Zealand. Promising material has been obtained from Californian x Fuggle. Bullion has yielded badly but, on account of its root-rot tolerance and high α-resin content, should prove useful in breeding.

MINOR CROP PLANTS

785 Dempsey, A. H.
Inheritance studies of certain fruit and plant characters in *Capsicum frutescens*.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–5372 : 2506–07. (Abst.).

The inheritance of several characters was analysed in Santanka (Japanese introduction) x Truhart Perfection. Data on plant height were interpreted on the basis of control by three pairs of polymeric genes. Fruit shape was controlled by "one gene pair with incomplete dominance and multiplicative effects." Eight pairs of genes with "multiplicative, cumulative effects" determined fruit-wall thickness. Pungency (determined by a test with vanadium oxytrichloride in carbon tetrachloride), pendent fruit position, small stem diameter and susceptibility to *Xanthomonas vesicatoria* were inherited as monogenic, dominant characters. Linkage between pungency and erect fruit position was established from F_2 data, the cross-over value being 0·3443 ± 0·0387. Lines homozygous for resistance to *X. vesicatoria* were obtained in the F_3.

786 Hirose, T.
(Studies on the pollination of red pepper. II. The capacity for fertilization of the pistil and bud pollination).
Kyoto Daigaku Gakujutsu Hokoku : Nogaku/Sci. Rep. Kyoto Univ. : Agric. 1959 : No. 11 : 31–37. [Japanese].

Pollen-tube growth in the style is slow and a minimum of 6 hr. is required for fertilization. Bud pollination gives a markedly reduced set and this is further reduced by high temperature. The set from old-flower pollination is also depressed by high temperature. [Cf. XXIX, 585].

787 Sowell, G. (Jun.).
Bacterial spot resistance of introduced peppers.
Phytopathology 1960 : **50** : p. 577. (Abst.).

Greenhouse and field tests were used to determine resistance to *Xanthomonas vesicatoria* in 30 commercial varieties and 600 introductions. The highest level of resistance was found in PI 163184, 163189, 163192, 164471 and 164677, all from India, and in the variety Anaheim. In the field test, the varieties Red Chile and Santanka were more resistant than California Wonder or Improved Truhart Pimiento.

788 Murakishi, H. H.
A necrotic pod streak of pepper caused by tobacco mosaic virus.
Phytopathology 1960 : **50** : 464–66.

A virus shown to be a strain of tobacco mosaic virus caused necrotic pod streak in *Capsicum annuum* 'Hungarian Sweet', a small-fruited variety. Two related varieties, Hungarian Yellow Wax and Yellow Long Sweet, were similarly affected. A number of large-fruited mild and small-fruited pungent varieties tested all showed leaf or stem symptoms but did not show necrotic streaking of the pods.

789 Hopfe, W.
Zur Züchtung ertragreicher Winterrapsformen mit relativer Spätsaatverträglichkeit. (**On breeding productive forms of winter rape with relative tolerance of late sowing**).
Dtsch. Landw., Berl. 1960 : **11** : 331–33.

The new Gross Lüsewitz line 52/1655 has outyielded standard varieties by about 7% when sown in mid-August and by 15% when sown at the beginning of September. The highest yields are obtained when sowing is completed before the end of August.

790 Winterkoolzaad, 1960. (**Winter swede rape, 1960**).
Landbouwvoorlichting 1960 : **17** : Bijl. 70; Ber. Rassenkeuze No. 287 : unpaginated.

In tests of five varieties conducted since 1950 on different soil types in the Netherlands, the German variety Rapol and the Netherlands variety Mansholt's 2956 gave very good yields and were rather earlier than Lembke's.

791 MORICE, J.
La sélection du colza d'hiver basée sur l'étude des composantes du rendement. (**Breeding of winter rape based on the study of yield components**).
Ann. Inst. nat. Rech. agron., Paris : Sér. B. 1960 : **10** : 85–116.

A statistical analysis of yield and yield-component data has indicated the existence of significant correlations between the weight of seeds per pod of mother plants and the average yield of their progeny, showing the possibilities of this character as a selection criterion in the breeding of improved winter rape. The number of pods per plant is also a useful character, but during the first generations it is more advantageous to select for weight of seeds per pod. Within material already selected in this manner, the highest-yielding lines are those which have the greatest number of pods.

A trial with the varieties Hambourg, Alsace and Sarepta showed that it was not possible to offset low plant productivity by increasing the density of the stand.

A genetic study of the quantitative characters influencing yield was carried out by means of diallel crosses between lines derived from populations of Eure II, Lembke 5–6, Orléans and Pays de Caux. The results indicated that heterosis in the progeny of these crosses could be attributed, in most cases, to the additive effects of more or less dominant genes. There was evidence that the limits of selection in certain crosses had been reached, largely because the parental lines involved had already undergone selection for the genes in question.

792 CREECH, R. G. & KRAMER, H. H.
Gene interaction in *Ricinus communis*, L.
Agron. J. 1959 : **51** : 642–44.

At least three factors appear to be involved in the inheritance of plant colour. *R* is a partially dominant gene for red plant colour, the recessive *r* having no visible effect. Dominant *Y* is postulated to control normal green plant colour, recessive *y* producing yellow capsules and yellow-green stems. *Y* and *R* in the absence of an inhibitory gene *I* produce maroon stems and purple capsules. The factors *y* and *R* in either the presence or absence of *I* or *i* produce red capsules and maroon stems. Recessive *i* has no visible inhibitory effect; this factor may be identical with factors *g* and *r* mentioned in early work by Harland and Peat and by Gurgel respectively. The factor *R* may be the same as Harland and Peat's factor *M*. The interaction of *Y*, *I* and *R* is reported here for the first time.

Crosses of plants with spiny and with smooth capsules gave intermediate-spiny capsules in the F_1 and spiny, intermediate-spiny and smooth segregates in the F_2. One partially dominant factor *S* produces spines on capsules, the recessive *s* producing no spines. Dominance modifiers were indicated in certain crosses. The gene *S* may be the same as gene *S* reported by Harland.

Three genes designated *A*, *B* and *C* were found to condition bloom inheritance. *A* and *B* are complementary, partially dominant genes producing bloom, while *C* is a partially dominant gene which intensifies the action of *A* and *B* to produce heavier bloom. *C* is ineffective in the absence of *A* or *B* or both. Gene *A* may be the same as White's and Harland's gene *B*. *A* and *B* may be identical with Gurgel's genes C_1 and C_2 and Zimmerman's B_1 and B_2 [cf. XXVIII, 2032]. The interaction of *C* with genes *A* and *B* is reported here for the first time.

Tests for linkage indicated that all the factors were independent except for the colour factor *R* and the bloom factor *A*.

793 BORREGO, J. & SÁNCHEZ, N.
Estudios con ajonjolí en el noroeste. (**Studies on sesame in the north-west**).
Agric. téc. Méx. 1959 : No. 8 : 30–31.

This article on improving yields in north-western Mexico includes data on the number of days to flowering, height, number of days to harvesting and yield for the 20 best lines and varieties out of 87 tested.

794 CULP, T. W.
Inheritance of papershell capsules, capsule number and plant color.
J. Hered. 1960 : **51** : 146–48.

A study of the phenotypes of two progenies in two sesame crosses indicated that paper-shell capsule is inherited as a simple recessive; a third cross, however, indicated that the character is the result of duplicate recessive epistasis. It was confirmed that the inheritance of capsule number is controlled by one pair of Mendelian factors with one capsule per leaf axil dominant over multiple capsules per leaf axil. Other data indicate that green colour is dominant over purple and that the expression of this character is controlled by one pair of genes. No interactions or linkage were found between any of the characters studied.

795 **New flax variety in California.**
Crops & Soils 1960 : **12** : No. 7 : p. 20.

New River is high-yielding and wilt resistant and has a higher oil content than either of its parents, B–5128 and Punjab. It has short, relatively stiff straw and large seed and is able to flower and set seed late in the growing season. The new variety tends to lodge more than Imperial but has been consistently better than Punjab 53; it is expected to replace the latter in the Imperial Valley of California.

796 BATCHA, M. G. B. R., KEDHARNATH, S. & JOSHI, A. B.
A rapid method for determining quality of oil in linseed.
Indian Oilseeds J. 1960 : **4** : 170–73.

Analysis of 100 varieties maintained at the Indian Agricultural Research Institute, New Delhi, revealed a high positive correlation between iodine value and refractive index. Quality evaluation, based on refractive-index readings, may therefore be used as a much more rapid method than iodine-value determination.

797 OBOLENSKY, G.
Notes on the development of a commercial practical sunflower variety.
Qual. Plant. Mater. veg. 1960 : **7** : 55–64.

A breeding programme is outlined and the possibilities of improving agronomic characters are discussed. It is pointed out that plants with white seed have a uniform well-developed head and that shortening of the internodes facilitates harvesting without decreasing yield; nonbranching is an hereditary character influenced by the environment. A deposit of phytomelan in the seed coat, a dominant character, confers immunity to attack by larvae of *Homeosoma nebulella*. Resistance to broomrape is a dominant character when present in the female parent. Soil and climate have been found to influence the interaction of the host and parasite. The "wild sunflower", *H. tuberosus* and *H. maximiliana* are resistant to *Orobanche* and *H. debillus** and *H. cucumerilius*† are slightly resistant. Crosses between annual and perennial sunflowers produce only a few fertile offspring but fertility increases with subsequent generations; the germination of the seed from these crosses can be improved by treatment with 0·2% hydrogen peroxide. The hybrids can only be used for developing forage varieties on account of their great leafiness. Very few perennial plants with required characters have been found amongst the progenies. Hybrids between sunflower and Jerusalem artichoke have been easily obtained and back crossing to sunflower has produced perennial plants immune to disease. Most progenies from crosses between *H. annuus* and *H. ruderalis* have shown immunity to *Puccinia helianthimollis* and given greater yields than cultivated varieties. Crosses between *H. annuus* and *Carthamus tinctorius* and *Onopardon scanthium*‡ have been obtained by grafting the sunflower on to the other species before crossing; the F_1 has to be back crossed to stabilize the required characters. Progenies resistant to disease and drought have been obtained. In both reciprocal crosses the female parent shows complete dominance. High oil content is a dominant character greatly influenced by the amount of rain.

798 SINSKAJA, E. N.
(Physiological analysis of varietal populations of sunflowers).
Fiz. Rasten. (Phys. Pl.) 1960 : **7** : 225–31. [Russian].

Photoperiodic studies at Krasnodar showed that a variety or even a selected family is usually a population comprising biotypes differing in photoperiodic responses. The transition from one extreme variant of a population to the other was gradual. In some varieties the populations were only of the short-day or long-day biotype.

799 SUSLOV, V. P.
(The eminent Mičurinist breeder of oil crops, V. S. Pustovojt).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. **7** : 3–8. [Russian].

Research by Pustovojt on breeding sunflowers for improved oil content from 1912 onwards is surveyed. He was awarded the Lenin Prize in 1959 for the breeding of the new varieties Smena [Change] and Peredovik [Advance], both of which are said to have an oil content of 51%, and for the introduction of a seed-production scheme resulting in the continuous improvement of standard varieties.

800 **Description of a new variety.**
Forage Notes, Ottawa 1960 : **6** : No. 2 : p. 62.

The sunflower hybrid Admiral [S–37–388RR x (CM5 x CM27)], recommended for licensing in Canada, is superior to Advance and Advent in seed yield, oil content and weight per bushel. It carries the same dominant gene for rust resistance in southern Manitoba as Advent, S–37–388RR ♀ contributing this gene to both hybrids.

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* ? *debilis*

† ? *cucumerifolius*

‡ ? *Onoperdon acanthium*

801 **Performance of the rust resistant experimental sunflower hybrid S–37–388RR x (CM 5 x CM 27).**
Forage Notes, Ottawa 1960 : **6** : No. 2 : 62–66.

Data are provided on the performance of the three-way hybrid Admiral [cf. 800] in comparison with Advance, Advent and Beacon. Commercial seed of Admiral is expected to contain a higher percentage of hybrids than that of the single crosses Advance and Advent. It is produced by growing four rows of the vigorous, high-yielding ♂ parent CM5 x CM27 to two of the ♀ (S–37–388RR). In the seed production of Advance and Advent, the row ratio is 2 : 2 and a higher number of rows of the inbred ♂ parent is not used because its low yield would raise the cost considerably if it occupied a larger portion of the crossing block.

802 Palma Africana: producción de semilla en Colombia. (**African oil palm: seed production in Colombia**).
Bol. Divulg. IFA Bogotá 1959 : Nos. 14–15; 15–18.

This account of seed production in Colombia includes descriptions of the *dura*, *tenera* and *pisifera* types and their genetical relationships and an outline of the method of artificial pollination. Oil palm is regarded as a promising crop in the country.

803 BREDAS, J. & SCUVIE, L.
Aperçu des influences climatiques sur les cycles de production du palmier à huile. (**An outline of climatic influences on the cycles of production in the oil palm**).
Oléagineux 1960 : **15** : 211–24.

In experiments at Yangambi, no clear association was found between climate and leaf production, probably because of the immaturity of the populations. Sexual differentiation of the inflorescence was influenced by conditions obtaining at flower-bud initiation 30–36 months before flowering, a dry period favouring the production of female flowers. A high rate of flower abortion was associated with the coincidence of a dry period with the phase of rapid growth of the inflorescence 4–6 months before flowering.

804 DEVREUX, M. & MALINGRAUX, C.
Pollen de *Elaeis guineensis* Jacq. Recherches sur les méthodes de conservation. (**Pollen of *E. guineensis* Jacq. Research on preservation methods**).
Bull. INÉAC 1960 : **51** : 543–66.

This study indicates that oil-palm pollen, required for artificial hybridization, is best dried in an oven at 40° C. for 24 hours. To prevent excessive variations in humidity, the pollen should be kept in special drying envelopes during this process. The best conditions for subsequent preservation are low temperature (5° C.) and a relative humidity of about 15%.

805 SPARNAAIJ, L. D.
The analysis of bunch production in the oil palm. I. Introduction. II. Observing and recording the components of bunch production. III. Variability of the components of bunch production. IV. An example of a complete analysis of bunch production. V. Additional experimental data on the relationship between bunch production and environment. VI. Discussion of practical considerations and further research.
J. W. Afr. Inst. Oil Palm Res. 1960 : **3** : 109–80.

Using data from cultural experiments and progeny trials at the West African Institute for Oil Palm Research, Nigeria, an analysis is given of growth and flowering under different environmental conditions, the following main components of bunch production being considered in an attempt to understand how yield differences arise: leaf production, floral abortion, sex ratio, survival of ♀ inflorescences after flowering and average bunch weight. In Part III, the influence of age, soil conditions, season, climate and genetic constitution upon each of these components is examined. Part VI includes a discussion of the significance of production analysis for the study of breeding problems, such as selection of palms suitable for marginal conditions, the sterility of *pisifera* and the relationships between shell thickness and sex ratio.

806 HADDON, A. V. & TONG, Y. L.
Oil palm selection and breeding: a progress report.
Malay. agric. J. 1959 : **42** : 124–46.

Yield trials of dumpy, semidumpy and normal (tall) *dura* palms and of semidumpy x dumpy back-cross and semidumpy sib-cross progenies are reported. Yields of dumpy palms were disappointing but the back crosses show a distinct improvement in bunch quality and a number of lines are nearly dumpy in habit. Studies are in progress to determine the best kind of *dura* palm for use in *tenera* seed production. Pollen of the West African "short" *pisifera* palm INÉAC 16R is being used to produce dumpy *tenera* palms. A comparison of *tenera* palms descended from fertile and infertile *pisifera* parents is under way.

807 WULFF, H. D. & STAHL, E.
"Chemische Rassen" bei *Acorus calamus*. **("Chemical races" in *A. calamus*).**
Naturwissenschaften 1960 : **47** : p. 114.

The essential oils from diploid races contained large proportions of geranyl acetate, which was absent in the triploid races investigated; these contained large quantities of asarones, which were practically absent in the diploids. The tetraploid race examined contained less asarones than the triploid in the leaves but more in the rhizomes.

808 CZABAJSKA, W., DUCHNOWSKA, A., PAWEŁCZYK, E. & WROCIŃSKI, T.
Hodowla naparstnicy purpurowej (*Digitalis purpurea* L.). I. Selekcja naparstnicy purpurowej. [**Breeding of foxglove (*D. purpurea* L.). I. Selection of foxglove**].
Biul. Inst. Roślin Leczn. 1959 : **5** : 252–67.

In ten years' breeding work at the Polish Institute of Medicinal Plant Breeding, the heritability of anthocyanin content, hairiness, flower colour, plant height, leaf position in the rosette, leaf morphology and stamen colour has been established. Although a method of sib crossing was employed, no inbreeding depression was detected. Total glycosides, determined chemically, varied from 0·168% in strain XIK/28 to 0·472% in I Am (41). The proportion of digitoxin was 79% in X IC_1 (6). Strains with a high digitoxin content normally had also a high content of gitaloxin, but the reverse was not true. Strospeside was present in a proportion of 5·09–13·09% of the total glycosides. High leaf yield was associated with low drug content.

809 KRISHNA KUMAR JHA & UMAKANT SUHA
Chromosome number in *Leucas aspera* Spreng.
Curr. Sci. 1960 : **29** : 231–32.

L. aspera, a species of medicinal value, proved to be diploid, with $2n = 22$. Meiosis was normal.

810 Ante los resultados de la variedad "Klein" en las siembras de maravillas. **(On the results with the variety Klein in sowings of *Mirabilis*).**
Campesino, Santiago 1960 : **92** : No. 5 : p. 34.

The seed of this new Chilean variety has a much higher oil content than other varieties of *Mirabilis*.

811 ROY TAPADAR, N. N. & NIRAD KUMAR SEN
Cytotaxonomical studies on the economic plants of the family Apocynaceae.
Caryologia 1960 : **12** : 367–96.

Observations are reported on the mitotic and meiotic chromosomes of 28 species and varieties with medicinal, ornamental or other economic value belonging to the following genera: *Allamanda, Carissa, Rauwolfia, Hunteria, Kopsia, Plumeria, Alstonia, Holarrhena, Ervatamia, Thevetia, Strophanthus, Nerium, Beaumontia, Trachelospermum, Aganosma* and *Wrightia*. *Rauwolfia, Alstonia* and *Holarrhena* were among the genera with $x = 11$ and *Strophanthus* was among those having $x = 10$. Polyploidy and structural alteration of the chromosomes have played important roles in the speciation of the economic members of the Apocynaceae.

812 MAUGINI, E.
Richerche sulla citogeografia e sulla tassonomia dell'*Urginea maritima* Bak. **(Researches on the cytogeography and taxonomy of *U. maritima* Bak.).**
Caryologia 1960 : **13** : 151–63.

Diploid ($2n = 20$), triploid, tetraploid and hexaploid biotypes have been found in Italy and the Mediterranean islands and data are given on their geographical distribution.

813 Institut des Recherches sur le Caoutchouc au Cambodge. Rapport Annuel 1958. **(Institute of Research on Rubber in Cambodia. Annual Report, 1958).**
1959 : Pp. iv + 89.

Details are presented of breeding work and clonal trials at Tapao and other stations in Cambodia. PR107 has continued to give high yields, while IRCI7, PB86, AVROS308 and AVROS322 have also been satisfactory, together with a number of newly introduced IRCI clones. In trials of legitimate and illegitimate seedlings, the families Waring 4 x AVROS152 and DJ1 x Tjir 1 have performed best.

814 Institut des Recherches sur le Caoutchouc au Viêt-Nam. Rapport Annuel 1958. **(Institute of Research on Rubber in Viêtnam. Annual Report 1958).**
Laikhê 1959 : Pp. 250.

Information is provided on breeding work and clonal trials at experiment stations in Viêtnam. Several legitimate and illegitimate seedlings have done well, particularly AVROS80 x

AVROS163. Among clones which have performed consistently well at Laikhê are IRCI7, IRCI9, OY1 and PB86. [Cf. XXIX, 3002].

815 Mendes, L. O. T.
Observações sôbre a productividade de seringueiras (*Hevea brasiliensis* Muell.-Arg.) plantadas de sementes. [**Observations on the productivity of rubber seedlings (*H. brasiliensis* Muell.-Arg.)**].
Bragantia 1959 : **18** : 417–40.

A wide variation in the latex yield of 31 seedlings raised at Belém, Brazil, is reported. Some 50% of the population yielded 75% of the total production so that if the seedlings are planted at high density, thinning can eliminate the low yielders and produce a commercial stand of high-yielding trees.

816 Bouharmont, J.
Recherches taxonomiques et caryologiques chez quelques espèces du genre *Hevea*. (**Investigations in taxonomy and caryology in some species of the genus *Hevea***).
Sér. Sci. INÉAC 1960 : No. 85 : Pp. 64.

At Yangambi, the following five species of *Hevea* have been studied: *H. guianensis*, *H. collina*, *H. benthamiana*, *H. brasiliensis* and *H. spruceana*. The genus is characterized by considerable subspecific morphological variability, and species discrimination is often difficult. Natural hybridization is a frequent occurrence within the genus. Cytologically, the species are very similar and all have $2n = 36$. Meiosis was identical in all species and normal except that at diacinesis one to three quadrivalents were sometimes observed. These results, taken in conjunction with other findings reported in the literature, lead to the conclusion that *Hevea* has an amphidiploid origin, being derived from a cross between two primitive species possessing similar genomes and with $2n = 18$.

817 Marzocca, A.
Cultivo y mejoramiento de *Taraxacum kok-saghyz*. Reseña de trabajos efectuados en el Centro Nacional de Investigaciones Agropecuarias (1951–1959). [**Cultivation and breeding of *T. kok-saghyz*. Survey of work carried out at the National Centre of Agricultural Investigations (1951-1959)**].
Idia 1960 : No. 149 : 17–37.

This account includes a list of introduced varieties and of selections developed at the Argentine Institute of Agricultural Botany. A well adapted line from the original material received from America is AM. The Swedish line Sv. 54–402 (J), which has a high rubber content, is being used in breeding.

818 Mendes, L. O. T.
Seleção e melhoramento do timbó. I. Estudo de uma população de 235 plantas de timbó urucu (*Derris urucu* (Killip & Smith). [**Selection and improvement of derris. I. Study of a population of 235 plants of *D. urucu* (Killip & Smith)**].
Bragantia 1959 : **18** : 483–515.

Data are provided on the root yield and rotenone and degueline contents of 235 samples obtained originally from the Ilhas region of the Amazon. The maximum rotenone content was 11·2% and degueline content, 11·4%.

819 Irvine, J. E. & Freyre, R. H.
Varietal differences in the rotenoid content of *Tephrosia vogelii*.
Agron. J. 1959 : **51** : 664–65.

Rotenoid content was determined in the leaves of 16 varieties from diverse sources. Varietal means were found to range from 0·0 to 2·9% of dry weight. A negative correlation was found between leaf rotenoid content and plant height.

FRUITS AND NUTS

820 Pearce, S. C. & Brown, A. H. F.
Improving fruit tree experiments by a preliminary study of the trees.
J. hort. Sci. 1960 : **35** : 56–65.

This investigation illustrates "calibration", whereby the performance of trees under experimentation can be considered in relation to what might have been expected of them had not differential treatments been applied.

821 Tomcsányi, P.
Vorschläge zur Sortenprüfung bei Obstbäumen. (**Proposals for variety testing in fruit trees**).
Arch. Gartenb. 1959 : **7** : 516–46.

The value of a fruit cultivar is considered as being made up of its yield and various points determining quality and marketability, divided by the price of production. Three stages of approval for fruit varieties in Hungary are referred to, viz. provisional approval, national approval and inscription in the breed book. The first two stages are based partially on indirect assessments, and can take place after 2–3 years and 5–7 years respectively, whereas inscription is done on the basis of results in actual cultivation and is possible only after some 20 years. A full description is given of the methods employed in carrying out the tests. New cultivars are invariably compared with known local varieties of the same maturity period. Observations are made in a number of representative localities at differing phases of growth, the data are recorded on to tabular forms and the results are calculated mechanically. Since market value and cost of production can be estimated only approximately, extreme accuracy in determining yield is not considered necessary.

822 KOBEL, F.
Die Sortenfrage im Obstbau. **(The question of varieties in fruit cultivation).**
Schweiz. Z. Obst- u. Weinb. 1960 : **69** : 361–64.

Mention is made of the testing of foreign varieties and breeding being carried out in Switzerland, breeding aims for tree fruits being defined. The tendency is now to put more emphasis on quality and a number of varieties are mentioned which are no longer acceptable to the market.

823 HOUGH, L. F.
Modern plant exploration through cooperation.
Hort. News, NJ 1960 : **41** : 4051–52.

Mention is made of some pear, apple, peach, apricot, cherry and plum varieties observed by the author while in Yugoslavia. A very hardy, large, firm and early peach seedling which has been named Yugoslavia is regarded as particularly promising.

824 HARTMAIR, V. & HÖZL, H.
Ein Beitrag zur Frage der Lagerfähigkeit von Pollen verschiedener Obstgehölze. **(A contribution to the question of the storage capacity of pollen of different fruit trees).**
Mitt. Klosterneuburg : Ser. B. 1959 : **9** : 1–9.

Tests of a number of varieties of apple, pear and plum showed marked varietal differences in the germination capacity of the fresh pollen and in the length of time the pollen remained viable when stored at a relative atmospheric humidity of 40% and a temperature of + 2–4° C. The pollen of some varieties of plum and apple could be stored for up to a year without total loss of viability; pears lost their viability sooner. The varieties with the best initial germination were not always those that retained it longest.

825 WUTTKE, W.
Bericht über die Tagung der Obstzüchter in der Sowjetunion. **(Report on the meeting of fruit breeders in the Soviet Union).**
Dtsch. Gartenbau 1960 : **7** : 19–20.

Among the topics discussed at a meeting held in Moscow on 14–19 August 1959 were the value of local forms of fruit trees in the USSR and China for breeding hardy cultivars, the use of polyploidy and the production of mutants by irradiation.

Many speakers emphasized the need for greater winter hardiness and new hardy, scab-resistant apples were reported from Leningrad. Frost damage to apricots has been reduced by breeding forms with a long dormancy period; varieties that ripen earlier have also been produced. Reference is made to hybrids between *Prunus domestica* and Hansen's hybrids Waneta and Opata, to a number of improved varieties of sweet cherry and to peach hybrids combining greater hardiness, yield and fruit quality.

826 JOHANSSON, E.
Förvaringsförsök med päron och äpple vid Alnarp 1954–1958. **(Storage experiments with pear and apple at Alnarp, 1954-1958).**
Medd. Trädgårdsförs. 1960 : No. 129 : Pp. 56.

Among pear and apple varieties tested under various conditions of storage, the pears Charneu, Conference, Doyenné du Comice and Herzogin Elsa and the apples Cortland, Cox's Orange, Lundbytorp and Laxton's Superb generally gave good results.

827 GORŠKOV, I. S.
(The breeder's tasks in promoting progress in horticulture).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 1 : 9–12. [Russian].

Soviet breeding aims with fruit trees are outlined and general recommendations as to initial material which should be used to obtain cold-resistant varieties of apple, pear and sour cherry are made.

828 LALATTA, F.
Il miglioramento varietale del melo. **(The varietal improvement of the apple).**
Progr. agric. 1960 : **6** : 685–92.

Apple breeding in the warmer temperate countries is reviewed with special reference to Italian requirements.

829 BOGDANOVA, JU. G.
(Studying apple varieties at the experimental teaching farm of the White Russian Agricultural Academy).
Trud. Belorussk. sel'skohozjajstv. Akad. (Trans. White Russ. agric. Acad.) 1959 : **32** : 132–38. [Russian].

Data on cropping, periodicity, keeping quality and dates of flowering for 50 varieties which have been tested in the Gorki district are presented. The results of one-year tests for winter hardiness and resistance to scab are also given.

830 PLEHANOVA, F. F.
(An eminent plant breeder I. Ja. Magomet).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 3 : 63–64. [Russian].

The achievements of Magomet in breeding horticultural plants, mainly in the Ukraine, are discussed on the occasion of his eightieth birthday. Mention is made of the apples Kal'vil' Aromatnyj [Aromatic Calville], Snežno-beloe [Snow-white] and Narodnoe [People's] and the plum Stahanovka [Stahanovite], all distinguished by good flavour and high yields.

831 MURAWSKI, H.
Beiträge zur Züchtungsforschung beim Apfel. V. Phänologische, morphologische und genetische Studien an Nachkommen aus Kreuzungen der Ananas-Renette mit sieben Kultursorten.
(Contributions to breeding research in apple. V. Phenological, morphological and genetical studies on progenies from crosses of Ananas Renette with seven cultivated varieties).
Züchter 1960 : **30** : 134–47.

Seven varieties differing in many characters were used as pollen parents in crosses with Ananas Renette. Both time of coming into leaf and time of flowering were inherited in a complex way and the behaviour of the parents did not always indicate that of the progeny. The combinations with Charlamowsky and Grüner Fürstenapfel [Green Prince apple] were earlier in both respects than the other combinations. Although Ananas Renette and Weisser Winterkalvill [White Winter Calville] begin flowering at the same time, many of their progeny flowered earlier. Weisser Winterkalvill was responsible for this result for crosses of Ananas Renette with other varieties flowering at the same time did not give early progeny. In a similar way Weisser Winterkalvill transmitted early leafing to its progeny. Beaumanns Renette and Langtons Sondergleichen [Langton's Unique] gave genes delaying flowering to their progeny but these genes were not expressed in the varieties themselves. Late flowering was clearly inherited from Wintergoldparmäne [Winter Golden Pearmain] and from this variety more genes for late ripening appeared to be inherited than from other varieties in the same maturity group. In the combination with Charlamowsky, early commencement of ripening was more frequent than late, whereas late ripening was prevalent in progeny of the cross with Langtons Sondergleichen. From the frequency distributions and the polygenic nature of this character it is assumed that in each case there is either incomplete dominance or a greater prevalence of one kind of gene. Most of the progeny of the cross with Grüner Fürstenapfel ripened very late; it seemed that both parents contributed genes for late ripening and these had a cumulative effect. The length/breadth ratio of the fruit was in most cases 0·7 to 0·8 but in the progeny of some crosses other values predominated. Seedlings with small fruit were frequent amongst progenies of the crosses with Baumanns Renette and Wintergoldparmäne. Most seedlings with medium-sized fruit were obtained from the combinations with Weisser Winterkalvill and Gelber Bellefleur [Yellow Bellflower]; these two varieties possess genes for large fruit. The cross with Grüner Fürstenapfel showed least variation in fruit size and also the highest proportion of small-fruited seedlings. It is concluded that fruit size is a polygenic character. Weisser Winterkalvill and Gelber Bellefleur with ribbed fruit had the highest percentage of progeny with this character; some varieties carried genes for ribbing although the character was not expressed. The russet spots of Ananas Renette were inherited in a complex way; most seedlings with russet spots were obtained from a cross between this variety and Gelber Bellefleur. Waxiness and roughness of the skin were also found to be under polygenic control. Progenies of Gelber Bellefleur, Wintergoldparmäne and Weisser Winterkalvill showed the highest percentage of individuals with deep yellow ground colour of the fruit skin. The combination with Grüner Fürstenapfel had most seedlings with greenish-yellow fruit colour. The crosses showed marked differences in segregation into different fruit colours. Differences were also found in the inheritance of red pigmentation occurring as a blush or as stripes and genetic control appeared to be complex. Baumanns Renette had most seedlings with a marked red coloration. Grüner Fürstenapfel, which shows no redness, had a relatively high proportion of progeny with red fruit. The combination with Charlamowsky gave many seedlings with whitish flesh, whilst yellowish flesh was frequent in progenies of Wintergoldparmäne, Gelber Bellefleur and Weisser Winterkalvill, the first two of these three varieties having themselves whitish flesh. Grüner Fürstenapfel had the highest proportion of seedlings with green flesh. Wintergoldparmäne had the highest percentage of seedlings with sweet fruit and the highest percentage with an insipid taste, whilst Charlamowsky produced many offspring with a sourish taste. Gelber Bellefleur had relatively few progeny with either an insipid or a definitely sour taste. The combination with Weisser Winterkalvill gave most fruit of dessert quality, the proportions for the other combinations being very low.

In relation to these results, the value of the varieties for breeding is assessed and suggestions made for future work.

832 MARRO, M. & COBIANCHI, D.
Caratteri differenziali nella "Richared" "Stark Delicious" e "Starking". (**Differential characters in Richared, Stark Delicious and Starking**).
Prog. agric., Bologna 1960 : **6** : 321–25.

The original Delicious apple is, it is submitted, the cultivar known in Italy as Stark Delicious, which is described, together with two bud mutants of it, Starking, which develops the fruit colour earlier, and Richared, in which the entire fruit is coloured. In this last cultivar a striped mutant has been found on a single branch, the fruits of which resemble those of Starking though the pigment develops later. A fruit of Stark Delicious with a sector resembling Richared is also described and illustrated.

833 (**Apple variety Slavjanka**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **3** : p. 37. [Russian].

A brief description of Slavjanka [Slav], bred by Mičurin many years ago, is given.

834 DRAGAVCEV, A. P.
(**Apples in China**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **4** : 56–60. [Russian].

General descriptions of the principal varieties and forms belonging to different species cultivated in China are given. The most important of these, *Malus domestica*, is represented mostly by American and Soviet cultivars, as varieties bred in China are still under trial. Next in importance are varieties of *M. prunifolia* var. *rinki*, which Chinese botanists regard as a separate species, *M. asiatica* Nakai. Other varieties grown for their fruits belong to *M. pumila*, *M. micromalus*, *M. niedzwetzkyana* and *M. formosana*. Some species are used chiefly as rootstocks. One of these, *M. hupehensis*, is also grown for its leaves as a substitute for tea.

835 (**The apple variety Kehura**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **4** : p. 31. [Russian].

The above Georgian variety is mainly notable for its keeping quality. The fruits ripen in October and can be stored for nearly two years. Being self sterile, it requires pollinators such as Handakura and other Georgian varieties.

836 MRAMORNOVA, V. V.
(**The apple variety Naliv Rozovyj**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **1** : 34–35. [Russian].

Naliv Rozovyj [Pink Juice] was among a few cultivars which have withstood the most severe winters in the Gor'kij province since 1938. It is resistant to scab and ripens earlier than Grušovka Moskovskaja [Moscow Pear] and produces fruits of superior quality. Naliv Polosatyj [Striped Juice] was another winter-hardy variety. It was selected from Naliv Rozovyj, from which it differs mainly by the appearance of the fruit and tree.

837 LAUBSCHER, F. X. & HURTER, N.
The chromosome numbers of seedling progeny from triploid apples.
S. Afr. J. agric. Sci. 1960 : **3** : 31–39.

Root-tip chromosome counts were made on 884 seedlings from six triploid varieties ($2n = 51$) growing in an orchard of mixed diploids ($2n = 34$) and triploids. The frequency distribution curve obtained was bimodal, with peaks at 41 and 44 chromosomes. From this, and from the observation that the frequencies of tetraploids and of aneuploids with numbers above 51 varied according to parental variety, it is inferred that the gametic chromosome number of triploid apples is under genotypic control. It is suggested that, although occurring in very low frequencies, tetraploids from triploid x diploid crosses may be better parents for breeding than those from colchicine-treated diploids.

838 RODIONENKO, A. JA.
(**An interesting form of apple**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **1** : p. 59. [Russian].

A seedling at Nežin bore flowers which had no petals or stamens, with the styles emerging from within closed sepals. It developed seedless fruits or those with only one seed, which had access to the outside air.

839 Žavoronkov, P.
(The apple variety Ural'skoe Nalivnoe).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 3 : p. 36. [Russian].

Ural'skoe Nalivnoe [Ural Juice] (Ranetka Krasnaja [Red Reinette] x Papirovka), bred at Čeljabinsk, is distinguished by great winter hardiness and withstands frost even at Omsk and Kemerovo. It is a good and early cropper. The fruits are small but their flavour is good.

840 Gubina, L. A. & Kralina, L. G.
(Preliminary results of varietal trials in Čuvašia).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 4 : p. 61. [Russian].

Six apple and two sour cherry varieties which proved winter hardy in Čuvašia are described.

841 Wartenberg, H.
Studien am Apfelmehltau *Podosphaera leucotricha* (Ell. et Ev.) Salm. mit Berücksichtigung einer normergisch-plasmatischen Abwehrreaktion. [**Studies on apple mildew *P. leucotricha* (Ell. et Ev.) Salm. with reference to a normal plasmatic defence reaction**].
Phytopath Z. 1960 : **39** : 16–64.

Observations were made on *Malus* species and varieties but it was not possible to distinguish differences in resistance to mildew under natural conditions because the attacks varied considerably in severity within clones. Also primary infection occurred by chance and susceptible plants may have escaped infection. The defence reaction of *Prunus* and *Malus* species is described.

842 Suhačev, A. D.
(Dwarfed apple trees).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 1 : 33–34. [Russian].

An apple tree with a dwarf habit was obtained by vegetative hybridization at Kinel' by using the apple Candille Sinap as a scion and *Amelanchier* as a stock. The adult tree is 150 cm. tall and crops annually. The vegetative hybrid was pollinated by several apple varieties and now several hybrid seedlings with a dwarf habit are available. They are expected to come into bearing shortly.

843 Zolotarev, V. P.
(At the new Rumanian scientific research institute of horticulture and viticulture).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 1 : 55–56. [Russian].

Plant breeding at the recently founded institute is mentioned briefly. The results include a pear hybrid (Beurré Hardy x Minister Doctor Lucius), characterized by late maturity and high quality of fruits with an average weight of 712 g. Also mentioned are Corna Neagra and other new vine varieties, distinguished by high yield, earliness, large grapes, good flavour and resistance to diseases.

844 Morettini, A.
Butirra rosata Morettini (Incrocio Coscia x B. Clairgeau). [**Morettini's Pink Beurré (from the cross Coscia x Beurré Clairgeau)**].
Ital. agric. 1960 : **97** : 807–10.

A description is given of the above variety which is characterized by red-flushed fruits of superior flavour. It ripens some days before Williams.

845 **Three new pear varieties.**
Agric. Res., Wash. 1960 : **9** : No. **3** : p. 16.

Magness and Moonglow are highly resistant to blight (*Erwinia amylovora*) and thus are suitable for the eastern and midwestern regions of the USA where it has been impossible to grow other high-quality varieties. Dawn is only slightly resistant to blight. Fruits of Moonglow and Dawn closely resemble those of Bartlett in shape and other respects but mature about two weeks earlier. Quite free of grit cells, Moonglow pears are well suited to canning and fresh uses. Dawn pears are small, juicy, spicy-flavoured and good for canning. A good dessert type, Magness matures about one week later than Bartlett.

846 Romanova, E. G.
(Utilize wider local varieties of fruit trees as hardy rootstocks).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 1 : 29–31. [Russian].

Collections of long-lived local apple, pear and plum varieties adapted to climatic and soil conditions in the Rostov and Stalingrad provinces are reported. The aim is to utilize them as hardy stocks for other varieties or to grow them on their own roots for direct use. Forms resistant to frost, drought, salinity and disease have been found. Some, for instance, the pear Černomjaska [Dark Flesh], are thought to possess breeding value. Černomjaska is early and productive of large fruits which have good flavour; its seedlings are uniform in fruit characters.

847 LAMB, R. C.
Resistance to fire blight of pear varieties.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 85–88.

Details are given of the method used at the New York State Agricultural Experiment Station to test reaction to *Erwinia amylovora* by artificial inoculation. The results of tests of 51 varieties during 1954–59 are summarized. Average percentage of the length of the shoots which blighted, i.e. ability to limit spread of the disease, is regarded as a better indication of resistance than proportion of inoculations which took. With the possible exception of Waite, all the most resistant varieties are poor in fruit quality but they may prove useful as sources of resistance in breeding.

848 CROSSA-RAYNAUD, P.
Nouvelles observations sur l'auto-compatibilité chez l'abricotier. **(New observations on self compatibility in the apricot).**
Ann. Serv. bot. agron. Tunis. 1957 : **30** : 33–43.

The degree of self compatibility of 27 American and European varieties of apricot was tested during a 5-year period at several locations in Tunisia. Only two were self incompatible, the remainder being wholly or partially self compatible. On the other hand, six out of eight local varieties were self incompatible, only Hamidi and Louzi blanc [White Louzi] showing limited self compatibility. The results indicate that the local varieties are comparable in this respect to varieties from Central Asia, the Crimea and the Irano-Caucasian area, while the European varieties, as has been suggested previously, behave in a distinct manner.

849 **(The myrobalan variety Pionerka).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **3** : p. 37. [Russian].

Pionerka [Pioneer] is a local Crimean variety of *Prunus cerasifera* with high regular annual yields and resistance to frost, drought and diseases. Its fruit is large, sweet and keeps well.

850 **(Žukov's sour cherry variety).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960. No. **1** : p. 35. [Russian].

This seedling of an unidentified variety from Mičurinsk is vigorous, winter hardy and comes early into bearing. It ripens at the same time as Vladimir and yields 30–40 kg. per tree. The fruit is dark red and has pleasant flavour.

851 FIRSOV, N. I.
(Sour cherry on the state farms of Rostov province).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **3** : 18–20. [Russian].

Varieties differing in growth periods and recommended for introduction in the above province are listed. All outyielded the standard Podbel'skaja in trials at the Batajsk Branch of the Institute of Plant Industry and had a good flavour. Španka, Žukovskaja and Rogneda had larger fruit than Ljubskaja.

852 VAN HEEK, L. A.
New canning peach varieties.
J. Dep. Agric. Vict. 1960 : **58** : 439–45.

Four new peach varieties developed at the Tatura Horticultural Research Station are described. Tatura Sunrise, derived from Levis Cling x Young's Cling, is an early variety maturing a week before Levis Cling. Fruit characteristics are good but thinning is required for the fruit size to be satisfactory. Preharvest drop is less than for either of the parents. Tatura Dawn is a Levis Cling seedling which matures at the same time as Tatura Sunrise. The tree sets good crops on untipped laterals and the fruit is easier to get up to size than either Young's Cling or Levis Cling. Preharvest drop is considerably less than in either of these two varieties. Tatura Sunset is a Pullar's Cling x Golden Queen cross which matures several days before Pullar's Cling. The colour and flavour of the fruit are good. The tree bears heavy crops of well-sized fruit and only requires light thinning in years of heavy set. A slight tendency to stone splitting in light crops is overcome by leaving laterals untipped. Tatura Aurora is a Yellow Transvaal x Pullar's Cling seedling maturing at the same time as Pullar's Cling. Fruit set is heavy and tipping of laterals is desirable to reduce the amount of thinning required.

853 THEOBALD, W. L. & HOUGH, L. F.
The relationship between stage of peach embryo development and seedling growth and survival.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 163–70.

Poor development and survival of seedlings of early ripening peaches have been a major obstacle in breeding still earlier-ripening varieties. A study of the above relationship was therefore undertaken at the New Jersey Agricultural

Experiment Station, using 16 genotypes of importance in the breeding programme. Survival was related to root growth but not to shoot growth. The results indicated that, for maximum survival, embryos of seeds of selections ripening 110 days after full bloom and earlier should be cultured just before or just as they attain full size.

854 ZAGAJA, S. W., HOUGH, L. F. & BAILEY, C. H.
The responses of immature peach embryos to low temperature treatments.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 171–80.

In other experiments at the New Jersey Agricultural Experiment Station carried out in connexion with problems of breeding early peaches [cf. 853], the time relationship between fruit ripening and embryo abortion and the after-ripening requirements of cultured immature embryos were determined in early-ripening varieties and selections.

855 Contributo allo studio delle cultivar di fico della provincia di Livorno. (**Contribution towards the study of the fig cultivars of the province of Livorno).**
Riv. Ortoflorofruttic. ital. 1960 : **44** : 194–208.

A study similar to that for the province of Pisa has been made for the Leghorn (Livorno) province [cf. XXX, 4267]. The two most common cultivars are Dottato and Verdino, already described. Descriptions are presented of nine others, two of them bearing twice and the others only once a year. In the latter group the variety Brogiotto nero [Black Brogiotto] is considered the best.

856 JARRETT, F. M.
Studies in *Artocarpus* and allied genera, V. A revision of *Parartocarpus* and *Hullettia*.
J. Arnold Arbor. 1960 : **41** : 320–40.

A further instalment provides a revision of the above two genera [cf. XXX, 3125].

857 EVREINOFF, V. A.
Étude pomologique sur le plaqueminier de Virginie (*Diospyros virginiana* Linné). [**Fruit studies on the persimmon (*D. virginiana* Linné)**].
J. Agric. trop. Bot. appl. 1959 : **6** : 574–81.

A description of 15 cultivars is included in this summary of information on the above crop.

858 GOPALKRISHNA, N. & KHANDUJA, S. D.
Improvement of guava by selection.
Poona agric. Coll. Mag. 1960 : **51** : 50–54.

Six improved varieties, which were selected at the Ganeshkhind Fruit Experimental Station, are described. The varieties are Lucknow–24, Lucknow–46, Nasik–88, Dholka–7, Dharwar–34, Kothrud–19 and Sind–63 [cf. XXX, 753].

859 BOWERS, F. A. I. & NAKASONE, H. Y.
Selection and naming of a new guava variety.
Hawaii Fm. Sci. 1960 : **8** : No. **4** : 1–2.

Selection standards used in improving guava at the Hawaii Agricultural Experiment Station are described. B–30, although having relatively low content of vitamin C and soluble solids, has proved to be highly acceptable by processors because of its strong pink colour, acidity and freedom from off-flavours. Its seed cavity is small with a low percentage of seeds. The selection, originating from a seedling population derived from fruits collected in Oahu, has been named J. H. Beaumont.

860 ISLAM, A. S.
Unproductivity in the colchicine-induced tetraploids of *Annona squamosa* L.
Nature, Lond. 1960 : **187** : 343–44.

Only two of the colchicine-treated plants referred to earlier [cf. XXIII, 2955] proved to be tetraploids when examined cytologically. Although flowering each year, they have remained unfruitful, in spite of hormone application and other treatments. Microsporogenesis was highly irregular meiotically, 80% of the pollen being unstainable. Trivalents, bivalents and univalents but no quadrivalents were observed. Failure in fruit formation may thus be primarily due to irregular meiosis, presumably in megasporogenesis as well as microsporogenesis.

861 PASEČNIK, S. T.
(A walnut form with burls at the root—into production).
Les. Hoz. (Forestry) 1960 : No. **6** : 14–16. [Russian].

Finds of trees with swellings at the base of the trunk which provide highly valuable timber are reported from Kirgizia. Sexual progenies raised from such trees on several forest farms bred true for the desirable character. Breeding and introduction of this sort of walnut are urged.

862 McKay, J. W.
Seed and seedling characters as tools in speeding up chestnut breeding.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 322–25.

The following variant characters in Chinese chestnut are described: orange kernel, snow kernel, the multiseeded condition, albino seedlings and red coloration in young seedlings. Genetic ratios in crosses made in the spring may be determined for such characters the following autumn or winter. The data so far obtained suggest that all five characters have a multiple-factor basis of inheritance. The carotene content of orange kernels is five times that of normal-coloured ones; attempts to develop a variety bearing only orange kernels are therefore justified. Further information on the inheritance of the multiseeded condition and snow kernels is desirable because of their economically deleterious effect. Snow kernels are completely devoid of pigment, the nuts being shrivelled and only one-fourth normal size. Young seedlings of pecan showed patterns of red-colour inheritance similar to those in the chestnut.

863 Urquijo Landaluze, P.
La protección del castañar. Las enfermedades y los insectos nocivos—situación y tendencias. Quince años de hibridaciones de castaños. (**The protection of chestnut stands. Diseases and insect pests—situation and trends. Fifteen years of hybridizing chestnuts**).
4e Sess. Comm. Int. Chât. 1958 : FAO/CH 25–Ca : Pp. 4. (Mimeographed).

Hybrids of *Castanea sativa* and *C. crenata* produced at the Phytopathological Station, La Coruña, Spain, during 1943–49 are very variable but show a high degree of resistance to *Phytophthora cinnamomi*, both under inoculation with the most virulent races and under heavy field infection. They are more vigorous than *C. sativa* and some are very precocious, flowering and fruiting in their second year. In the F_2 produced by intercrossing the hybrids in 1951, variation was greater and susceptibility to blight occurred in 25% of the plants. Selections for direct-producer types and rootstocks have been made.

864 Milsum, J. N.
The rambutan.
World Crops 1960 : **12** : 254–55, 264.

This article, which includes a short section on varieties, deals with recent work on the improvement of rambutan [cf. XXX, 1938].

865 Smartt, J.
Genetic instability and outcrossing in the groundnut variety Mani Pintar.
Nature, Lond. 1960 : **186** : 1070–71.

The above bunch type, obtained from the Queensland Department of Agriculture and Stock, has yielded consistently well in Northern Rhodesia. It has however the disadvantage of variegated red and white testa, although highly satisfactory in other respects. A strain of Mani Pintar breeding substantially true for self-coloured red testa has been selected which compares favourably with the parent variety in yield. Possibly the change from variegated to nonvariegated is a position effect.

Both variegated and nonvariegated brown-seeded material derived from Mani Pintar is of hybrid origin. Other evidence of outcrossing in this variety is mentioned.

866 Krapovickas, A.
Hibridación introgresiva en maníes de la región guaranítica argentina. (**Introgressive hybridization in groundnuts in the Guaraní region of Argentina**).
Idia 1960 : No. 150 : p. 62.

The considerable variability which exists in groundnut populations in this part of northeast Argentina is attributed to introgressive hybridization between three original types, *Arachis hypogaea* subsp. *fastigiata* var. *fastigiata* and *A. hypogaea* subsp. *fastigiata* var. *vulgaris* 'Porto Alegre' and 'Valencia'.

867 Kulkarni, Y. S., Gupte, A. K. & Pataskar, M. R.
A giant leaf mutant in groundnut.
Poona agric. Coll. Mag. 1960 : **51** : p. 35.

Two plants, with giant leaves and pods but smaller stature than normal, occurred in a pure crop of a spreading groundnut strain, Karad 4–11. The two plants, which like the normal have $2n = 40$, bred true during two successive generations, suggesting they are the result of a single mutation.

868 Gregory, W. C.
The peanut NC 4x, a milestone in crop breeding.
Crops & Soils 1960 : **12** : No. 8 : 12–13.

This new high-yielding, disease-resistant variety was developed at North Carolina by subjecting a superior strain of Virginia Bunch to X irradiation, and subsequent selection. The variety, which is thick-hulled, is not subject to growth cracking and kernel decay as is NC2, currently the most widely-grown variety in North Carolina.

869 TETENYI [TÉTÉNYI], P.
Les "taxons" infraspécifiques de l'arachide (*Arachis hypogaea* L.). [**Sub-specific taxa in the groundnut (*A. hypogaea* L.)**].
Oléagineux 1960 : **15** : 471–74.

A system of classification which is based mainly on morphological characters (number of seeds per pod, plant habit and pod length), but also on biological characters, is presented diagrammatically to show suggested relationships between the 14 groups distinguished. The scheme results from an examination of 140 varieties and does not include hybrids.

870 BERCHOUX, C. de
La rosette de l'arachide en Haute-Volta. (**Rosette disease of groundnut in Upper Volta**).
Oléagineux 1960 : **15** : 229–34.

It was confirmed that resistance to this disease is conferred by the genotype *aabb*. While resistant and susceptible plants are equally attacked by the vector, *Aphis leguminosae*, the former produce an antivirus substance. Under conditions of heavy infestation and with particularly virulent virus strains, localized chlorotic patches may appear on the leaves of resistant plants, due apparently to the plants' inability to produce sufficient amounts of this substance; this occurrence is particularly associated with the end of the growth cycle.

Trials of resistant lines are reported. Line 1040 has again given good results and is being distributed locally. Lines 1041 and 1042 are highly productive but have low germinative ability; they are to be further selected.

871 LIYANAGE, D. V.
Varieties and forms of the coconut palm grown in Ceylon.
Ceylon Cocon. Quart. 1958 : **9** : Nos. 3/4 : 1–10.

The indigenous coconut palms in Ceylon are classified into three varieties: *typica*, tall in habit, late flowering and predominantly outbreeding; *nana*, short in habit, early flowering and inbreeding; and *aurantiaca*, semitall, late flowering, inbreeding and with orange-coloured nuts. A total of 13 forms belonging to these three varieties are described. Among those regarded as particularly useful for breeding are Kamandala (high nut weight), Bodiri (prolificity in bearing, high oil content), Gon-thembili (low outturn, high oil content) and Pumila (early bearing, short habit) It is pointed out that the F_1 palms of *typica* x Pumila show considerable heterosis; they combine the physiological vigour of *typica* and the early-flowering habit of Pumila to give high yields as early as the sixth year after planting.

872 NAMBIAR, M. C. & SWAMINATHAN, M. S.
Meiosis in pollen sterile and pollen fertile varieties of coconut.
Curr. Sci. 1960 : **29** : 234–36.

Apricot and Dwarf Red had about 30% pollen sterility and Laccadive Ordinary 5%. Meiosis in the last variety was regular. The irregular meiosis observed in the other two is believed to be the cause of the higher amount of pollen sterility. It is suggested that inbreeding may be responsible for the pollen sterility found in dwarf varieties such as Apricot and Dwarf Red, since selfing may be possible to a greater extent in dwarfs because of overlapping of the ♀ and ♂ phases in the same inflorescence.

873 NIRMALENDU NATH & RANDHAWA, G. S.
Studies on floral biology in the pomegranate (*Punica granatum* L.). I. Flowering habit, flowering season, bud development and sex-ratio in flowers.
Indian J. Hort. 1959 : **16** : 61–68.

NIRMALENDU NATH & RANDHAWA, G. S.
Studies on floral biology in the pomegranate (*Punica granatum* L.). II. Anthesis, dehiscence, pollen studies and receptivity of stigma.
Ibid. 1959 : **16** : 121–40.

NIRMALENDU NATH & RANDHAWA, G. S.
Studies on floral biology in the pomegranate (*Punica granatum* L.). III. Pollination, fruit-set and seed formation.
Ibid. 1959 : **16** : 136–40.

A report is given of investigations on the above aspects of floral biology in the varieties Dholka, Double Flower, GB–1, Japanese Dwarf, Kandhari, Muscat White and Patiala at the Indian Agricultural Research Institute, New Delhi.

874 ZERPA, D. M. DE
Citología de híbridos interespecíficos en *Carica*. (**Cytology of interspecific hybrids in *Carica***).
Agron. trop., Venezuela 1959 : **8** : 135–44.

The number of chromosomes in *C. monoica*, *C. goudotiana* and *C. microcarpa* is reported as $2n = 18$. Two other species, *C. cauliflora* and *C. candamarcensis*, which together with the above three constitute the species of *Carica* grown at Maracay, Venezuela, were previously known to have the same diploid number.

The following interspecific hybrids were observed during microsporogenesis: *C. cauliflora* x *C. microcarpa*, *C. monoica* x *C. cauliflora*, *C. monoica* x *C. candamarcensis*, *C. goudotiana* x *C. monoica*, F_1 (*C. monoica* x *C. cauliflora*) x *C. candamarcensis* and *C. cauliflora* x *C. candamarcensis*. The last-mentioned hybrid tended to form polyvalents but all the others formed bivalents at metaphase I, indicating a high interspecific genetic affinity. In all hybrids, a certain number of hexads and pentads were produced; the percentages of sterility (30–50%) observed in the pollen are attributed to this abnormality. Very large pollen grains were frequently noted in two hybrids, *C. monoica* x *C. candamarcensis* and *C. cauliflora* x *C. microcarpa*, and are attributed to the formation of dyads and monads in these two hybrids.

875 Craig, D. L.
The cytology and breeding behavior of *R. canadensis* L.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–3431 : p. 3460. (Abst.).

"Clones of *Rubus canadensis* were found to vary in cane height, cane diameter, plant vigour, degree of spininess and fertility.

"Crosses between the spineless triploid facultative apomictic *R. canadensis* and tetraploid varieties of blackberries resulted in fertile hybrids. *R. canadensis* crossed with Lowden, Hedrick and Bailey blackberries produced triploid and pentaploid seedlings. The triploid seedlings were morphologically identical to *R. canadensis*. The reciprocal cross produced diploid, triploid, tetraploid and pentaploid seedlings as well as some seedlings with an unstable chromosome number. These results agree with observations on microsporogenesis where irregular configurations and asynaptic divisions were observed. Pollen grains were irregular in size and approximately 70 per cent aborted.

"An F_2 generation of a tetraploid hybrid seedling produced spineless diploid seedlings, spiny tetraploid seedlings and spineless tetraploid seedlings.

"It was concluded that the very desirable characteristics of *R. canadensis* could be transferred to cultivated blackberries through a proper breeding procedure." [Cf. 879].

876 Haskell, G.
Biometrical characters and selection in cultivated raspberry.
Euphytica, Wageningen 1960 : **9** : 17–34.

In studies of inbred, sib-crossed and back-crossed families, inbreeding depression affected plant height, vigour and mildew resistance; heterosis for fruit size was observed although large-fruited inbreds were also obtained. Height was closely correlated with vigour and there was an association between mildew susceptibility and poor first-year fruiting. Other characters studied were: spine frequency and colour; time of vegetative bud break, which showed low heritability; flower number per inflorescence; fruit colour, segregation for which occurred in some families; earliness of fruit ripening; maturity rate; double bearing, segregation for which occurred in some families; and fruit shape, texture and flavour. Back crossing to a clone of good flavour increased the proportion of good-flavoured seedlings and reduced that of acid types. In tasting trials, tasters were agreed on undesirable flavours but differed in their preferences. Of 36 seedlings selected as having the best "all-round" biometrical characters, 21 outyielded and four equalled the controls, indicating that this type of assessment is of value in sorting out potentially high yielders from a population.

877 Knight, R. L., Keep, E. & Briggs, J. B.
Genetics of resistance to *Amphorophora rubi* (Kalt.) in the raspberry. I. The gene A_1 from Baumforth A.
J. Genet. 1959 : **56** : 261–80.

The resistance of Baumforth A to *A. rubi* is controlled by a single dominant gene, A_1, conferring a high degree of resistance upon seedlings and mature plants. A semilethal condition appearing in selfed progenies of this variety was characterized by distortion of the young leaves, which were flecked with chlorophyll-deficient areas, and by severe reduction in growth. The abnormality depended on a single recessive gene, *fr* (frilly). A_1 and *Fr* were linked with a cross-over value of 3·3%. As shown by observations on hybrid derivatives of Baumforth A, the resistance of this variety is valuable for breeding, although partial breakdown may occur as the result of variability of the pest or, to a slight extent, leaf senescence.

878 Shoemaker, J. S., Wilson, J. W. & Sharpe, R. H.
Flordagrand. A new blackberry for home gardens and local markets.
Circ. Univ. Fla. agric. Exp. Sta. 1958 : No. S–112 : Pp. 8.

Developed from Regal Ness x *Rubus trivialis*, Flordagrand is evergreen, produces long attractive berries and begins to ripen about a month before wild blackberries in Florida.

879 Craig, D. L.
Studies on the cytology and the breeding behaviour of *Rubus canadensis* L.
Canad. J. Genet. Cyt. 1960 : **2** : 96–102.

Clones of *R. canadensis* collected from widely separated areas in Canada and the USA were all triploid ($2n = 21$). Seedlings from crosses between *R. canadensis* and seven commercial blackberry varieties had $2n$ numbers ranging from 14 to 35, two seedlings having a variable $2n$ number of 15–44. As ♀, *R. canadensis* gave rise to both apomictic triploid and sexual pentaploids. Used as ♂, it produced $2x$, $3x$, $4x$ and $5x$ seedlings, the majority being tetraploid. The species therefore formed functional ♂ gametes with varying chromosome numbers. All F_1 seedlings were spiny with considerable variation in leaf morphology according to $2n$ number. A spiny $4x$ F_1 plant from Maple Grove x *R. canadensis* flowered in the greenhouse. Of the 21 seedlings obtained by selfing this tetraploid, 3 were diploid and 14 tetraploid. The tetraploids were highly variable in leaf colour, shape and serration; this variability points to a sexual origin of the $4x$ progeny from this cross. The three diploids resembled *R. canadensis*; it therefore appeared that fertilization did not occur and most or all of the chromosomes contributed by the ♂ gamete in the formation of the original $4x$ hybrid functioned in the production of the ♀ gametes from which the diploids were derived. Four of the F_2 tetraploids were as free from spines as *R. canadensis*. Meiosis I and II in this species showed various irregularities. No typical configuration could be detected at metaphase I. It is concluded that the economically desirable characters of *R. canadensis* could be transferred to cultivated blackberries, given a suitably designed procedure of breeding. [Cf. 875].

880 Verslag van het zwarte bessenproefveld te Zeerijp over 1960. **(Report on the black-currant trial field at Zeerijp for 1960).**
Tuinbouwber., Groningen 1960 : **15** : p. 168.

Among ten varieties tested, the new varieties Daniels' September, Akkermans bes [Akkerman's currant] and Consort have shown promise.

881 **(The black-currant variety Nahodka).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **4** : p. 55. [Russian].

Nahodka [Find], selected at the Moscow Horticultural Research Station, is chiefly interesting for its resistance to cold, drought and *Pseudopeziza*.

882 **(The blackcurrant variety Pobeda).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **1** : p. 35. [Russian].

Pobeda [Victory] was obtained by crossing Goliath with a large-fruited seedling from Bijsk at the Moscow Horticultural Research Station. It is highly productive and winter hardy and superior to Lija Plodorodnaja [Productive Lia] in flavour and resistance to *Pseudopeziza*.

883 **(The gooseberry variety Kolhoznyj).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **3** : p. 37. [Russian].

Kolhoznyj [Collective Farm], bred at the Horticultural Station of the Timirjazev Agricultural Academy, ripens in July and is highly productive of dark red glabrous fruits rich in sugar and vitamin C.

884 Sortsforsøg med jordbær 1957–58. **(Varietal trials of strawberry, 1957-58).**
Tidsskr. Planteavl 1960 : **64** : 175–78.

Data are given on the yield and quality of 20 varieties, mostly introduced, tested at four stations in Denmark. Ydun and Senga Sengana were highest in yield, followed by Senga 54 and Senga 29, which both received high ratings for colour, flavour and texture.

885 Kronenberg, H. G. & Wassenaar, L. M.
Praktijkproeven met aardbeien in 1957–1959. **(Practical trials with strawberries in 1957-59).**
Meded. Inst. Vered. TuinbGewass. 1960 : No. 164 : Pp. 15.

Of 12 varieties tested in the Netherlands, Talisman, Vola, Gorella and two as yet unnamed varieties are recommended for further trial.

886 Bell, H. K., Downes, J. D. & Fulton, R. H.
Strawberry variety testing in Michigan, 1957-1959.
Quart. Bull. Mich. agric. Exp. Sta. 1960 : **42** : 836–44.

The results of trials of established and new varieties are reported. Two new red-core resistant varieties, Surecrop [XXVIII, 928] and Midway [cf. XXX, 4294], performed fairly well and are suggested for trial where this disease is a problem.

887 **News from the divisions.**
Fm. Res. News, Dublin 1960 : **1** : No. 3 : 5–6.

It is reported that in canning and jam-making trials of strawberries at the Soft Fruits Research Centre, Clonroche, Wexford, Eire, Talisman and Red Gauntlet were superior to Cambridge Rearguard.

888 Solnceva, M. P.
(The inheritance of characters in the F_1 in intervarietal hybridization of strawberries).
Bjull. Inst. Biol. Akad. Nauk Belorussk. SSR (Bull. Inst. Biol. Acad. Sci. White Russ. SSR) 1956 (1957) : No. **2** : 208–21 : from Ref. Ž. (Ref. J.) 1958 : No. **23** : Abst. 103365 : 36–37. [Russian].

Most F_1 crosses between such varieties as Komsomol, Negritenok, Uspeh [Success] and Mysovka [Bay] were found to be intermediate in respect of the following characters: size of fruit, number of flowers per inflorescence and number of inflorescence stalks. All the F_1 material was heterozygous for fruit colour and gave rise to progeny with dark-red, red and pale-red fruits. Red predominated over dark-red. Sex inheritance in crosses between pistillate and perfect-flowered forms was frequently not according to a 1 : 1 ratio, as a greater number of hermaphrodite plants arose than expected. This deviation is attributed to the more recent phylogenetic origin of the variety employed as the pollen parent.

889 Hull, J. W.
Development of colchicine-induced 16-ploid breeding lines in *Fragaria*.
Proc. Amer Soc. hort. Sci. 1960 : **75** : 354–59.

As a step preliminary to the establishment of a project designed to incorporate certain characteristics of *F. chiloensis* and *F. virginiana* into breeding lines of the cultivated strawberry, the possible advantages of working with 16*x* material instead of 8*x* were explored. Clones with 16*x* chromosomes in the L–2 histogenic layer or in both L–2 and L–3 were developed from mother plants raised from colchicine-treated F_1 seed of Missionary or Premier crossed with *F. chiloensis*. Details are provided of the methods applied at various stages in the development of these clones to detect chromosome doubling in the L–2 or L–3. These techniques included use of transmitted blue light in a darkened room to screen mother plants for chromosome doubling in the L–2 on the basis of certain foliage characteristics at the age of two months. Most of the plants affected were chimeral. No relationship was established between fruitfulness and percentage of pollen abortion in either the 8*x* or 16*x* hybrids, upon self or cross pollination. The general low level of fruitfulness encountered in both the 8*x* and 16*x* forms was probably genetic in origin. The fact that larger fruits were obtained with 16*x* in the internal tissues suggested, however, that breeding at the higher level of polyploidy may have an advantage as regards fruit size.

890 Kronenberg, H. G. & Wassenaar, L. M.
Gorella, een nieuw grootvruchtig aardbeiras. **(Gorella, a new large-fruited strawberry).**
Fruitteelt 1960 : **50** : 858–59.

Developed at the Netherlands Institute of Horticultural Plant Breeding, Gorella is distinguished by its robust growth and large, bright-red fruits resistant to mechanical injury. The fruits are borne well away from the leaves, so that picking is facilitated, and the calyx is also removed easily. Yield and flavour are satisfactory.

891 **(The strawberry variety Narodnaja).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **3** : p. 37. [Russian].

Narodnaja [People's] was obtained by crossing Jucunda with wild strawberry. It is highly productive of large fruit of high quality and produces fruiting runners.

892 Kluge, K.
Das Verhalten der diploiden Form von *Fragaria vesca* var. *semperflorens* im Vergleich mit der tetraploiden Form hinsichtlich Blüte und Scheinfrucht. **(The behaviour of the diploid form of *F. vesca* var. *semperflorens* compared with the tetraploid form in respect of the flower and fruit).**
Arch. Gartenb. 1959 : **7** : 589–606.

Comparisons were made in the period 1953–56 on 40 tetraploid and 10 diploid plants of the species. Though the peduncles were stronger in the tetraploids they bent over as in the diploids when the fruits ripened. The tetraploids had a smaller number of inflorescences and ripened 6–14 days later than the diploids; they stopped fruiting sooner than the diploids, which continued to bear fruit into October. The tetraploids had a smaller number of flowers, which had larger and broader petals, a smaller number of anthers and 40–70% of pollen grains that stained in acetocarmine as compared with

70–80% in the diploids; the difference in germination percentage was more marked. The achenes were larger in the tetraploids and their germination capacity was only 24%; the fruits were more variable in shape and mostly smaller and inferior in aroma. Some of the hybrids between the tetraploids and garden strawberries, however, had fruits with very good aroma.

893 SHEPHERD, K.
Seed fertility of 'Gros Michel' bananas.
Trop. Agriculture, Trin. 1960 : **37** : 211–21.

Further investigations on variation in seed yields from Gros Michel x *Musa acuminata* elucidated some aspects of the problem of the low fertility of such matings but did not lead to any practical solution [cf. XXIV, 2446]. The effects of season, field, pollen source, fertilizer, pruning and time of day at which pollination was carried out are analysed. In addition, notes on the germination of seeds from Gros Michel are included.

894 SHEPHERD, K.
Seed fertility of edible bananas.
J. hort. Sci. 1960 : **35** : 6–20.

A wide range of banana cultivars, mainly triploid but including three diploids and one tetraploid, were crossed with *Musa acuminata* sspp. *malaccensis* and *burmannica* and with *M. balbisiana.* It was noted that triploids of genomic constitution AAA or AAB were generally infertile, while the ABB triploids were usually fertile. It appears that the genetic factors controlling sterility are largely or wholly centred in the A genome, and that most of the sterility observed could be accounted for by embryo-sac failure. Fertility differences were noted between certain clones which were phenotypically very similar, and it is suggested that fertility could have been altered by somatic mutation.

Details are presented of the ploidy of the progeny resulting from the various crosses. Two contrasting types of behaviour were evident in the crosses involving certain ABB triploids. In Awak Legor and Nyeupe only unreduced and double restitution gametes yielded viable seeds, while in Red, Bluggoe and Ney Mannan successful embryo sacs were at least predominantly the products of irregular meiosis. The origins of fertile seeds and of sterility are discussed.

Studies on the following aspects are also reported: time of pollination, effect of hand order on fertility, the failure of pollen-tube growth and the distribution of seeds in different zones of the fruit.

895 TOBAR MARIÑO, G.
Algunos cruzamientos interespecíficos en *Musa.* (**Some interspecific crosses in *Musa***).
Acta agron., Palmira 1959 : **9** : 35–49.

Plants of the Hartón and Maqueño clones of *M. paradisiaca* were pollinated by clones Annan and Calcutta of *M. acuminata* and clone Ceylan of *M. balbisiana.* Both the latter species are fertile diploids. In all, 4773 pollinations were made and 1735 of the resulting fruits were examined. Only five seeds were obtained from the entire project, of which only one, derived from *M. paradisiaca* 'Hartón' x *M. balbisiana* 'Ceylan', germinated. This individual is now under further study.

The results confirm the parthenocarpy of the two clones of *M. paradisiaca,* and indicate that they are nearly, but not absolutely, sterile. The two phenomena appear to be closely related in these clones.

As a result of the artificial pollination, and possibly owing to its physiological effect, the number of fruits increased by 8·8% per bunch in the Hartón clone, and 6·4% in the Maqueño clone.

896 DE LANGHE, E. & DEVREUX, M.
Une sous-espèce nouvelle de *Musa acuminata* Colla. (**A new subspecies of *M. acuminata* Colla**).
Bull. Jard. bot. Brux. 1960 : **30** : 375–88.

M. acuminata subsp. *burmannica* is divided into two subspecies; one retains the old name, while the other is named *M. acuminata* subsp. *burmannicoides.* The subspecies are described and compared with *M. acuminata* subspp. *malaccensis* and *siamea.*

897 CASSIDY, N. G.
A varietal difference in the need of bananas for good drainage.
Agric. J. Fiji 1959 : **29** : 133–36.

Observations in Fiji have shown Cavendish and Lady's Finger to be much more tolerant of restricted drainage than Veimama.

898 STOVER, R. H. & WAITE, B. H.
Studies on *Fusarium* wilt of bananas. V. Pathogenicity and distribution of *F. oxysporum* f. *cubense* races 1 and 2.
Canad. J. Bot. 1960 : **38** : 51–61.

Race 1 of the banana wilt fungus is highly virulent on Gros Michel and other AAA hybrids of *Musa acuminata*, but does not attack ABB triploids of *M. acuminata* x *M. balbisiana*, such as Chato in Honduras, Chamaluco in Puerto Rico and other Central American banana and plantain varieties. Experiments in Honduras have indicated that the clones of *Fusarium* which do attack these varieties form a distinct race of the pathogen, race 2. Pathogenicity trials showed that race 2 also has the ability to infect AAA varieties, but to a far lesser degree than race 1. Both races proved to be pathogenic on three to four month old seedlings of *M. balbisiana*, *M. schizocarpa* and *M. acuminata* ssp. *banksii*; the race 2 clones were less pathogenic than the race 1 clones tested. Mature *M. balbisiana*, however, was found to be immune to rhizome infection by both races in the field. There are two major clonal groups within the pathogen and these are referred to as the cultivars Odoratum and Inodoratum. Both exist in race 1, while only the Inodoratum clonal group is found in race 2.

Race 1 has a world-wide distribution, while race 2 is confined to the Caribbean area and Central America, although there are unconfirmed reports of its presence on cooking bananas in India and Thailand. The evidence appears to indicate the independent evolution of race 2 in several locations.

The ABB varieties readily cross with *M. acuminata* (AA) and with *M. balbisiana* (BB) and seed set is satisfactory. Studies are now under way to determine the response of progeny of such crosses to races 1 and 2, and should help to elucidate the problem of the development of wilt-resistant bananas through breeding.

899 Loos, C. A. & Loos, S. B.
The black-head disease of bananas (*Musa acuminata*).
Proc. helm. Soc. Wash. 1960 : **27** : 189–93.

Burrowing nematodes (*Radopholus similis*) collected from Gros Michel rhizomes in the Republic of Panama were found to differ physiologically from those found in Lacatan rhizomes imported from Jamaica, WI.

900 Sefick, H. J.
Clemson grape breeders seek new varieties.
SC agric. Res. 1958 : **5** : No. **3** : unpaginated.

A short review is given of progress in developing new grape varieties at the Agricultural Experiment Station, Clemson, South Carolina. The hybrid Alden x Athens has large fruits of fair to good quality.

901 Huglin, P. & Schwartz, J.
Essai d'obtention et de dégustation de jus de raisin à partir d'hybrides-producteurs. (**Trial on the procurement and tasting of grape juice from hybrid producers**).
Ann. Inst. nat. Rech. agron., Paris : Sér. E : 1960 : **9** : 53–65.

This trial has shown that high-quality grape juice may be obtained from certain hybrids. The product was superior to that produced by currently-grown commercial varieties. The outstanding hybrids were 191–1 Kuhlmann, 244 Landot, 4643 Seibel, 5276 Seyve-Villard and 3 Rudelin.

902 Sousa, J. S. de
Mutações somáticas na videira Niagara. (**Somatic mutations of the Niagara grape**).
Bragantia 1959 : **18** : 387–415.

Descriptions are given of seven mutants of the above variety, introduced into Brazil in 1894: Rosada [Pink], Branca Gigante [Giant White], Branca Oval [Oval White], Rosada Gigante [Giant Pink], Rajada [Striped], Steck and Maravilha [Marvel]. Several of these mutants are of major economic importance in the state of São Paulo.

903 **[The vine variety Dodreljabi (Ox Eye)].**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **3** : p. 43. [Russian].

The above local Georgian vine, regarded as one of the best dessert sorts for glasshouse culture, is resistant to frost, drought, fungi and insects and yields up to 170 c. of large grapes per ha. It has perfect flowers, ripens late and grows well on most soils. The keeping quality is good.

904 **(The vine variety Čaras).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. **1** : p. 43. [Russian].

Čaras is regarded as the best dessert variety with dark berries in Uzbekistan, Tajikistan and Kazahstan. The flavour and keeping quality are good. It is also used for making a good-coloured dessert wine with an aroma reminiscent of almonds. Pollinators for this variety, which has hermaphrodite flowers, are listed.

905 Kondion, A. K.
(Reviewing the standard vine varieties in the Kazah SSR).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1960 : No. **5** : p. 61. [Russian].

Varieties which, it is thought, should be included among the Kazah standards are listed. They comprise high yielding wine varieties with a sugar content of 26–32% and dessert varieties having grapes with flavour and keeping properties superior to Madeleine Angevine.

906 Bessmertnov, V. V.
(Our observations on the vine variety Kujbyševskij Skorospelyj).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 4 : p. 49. [Russian].

Kujbyševskij Skorospelyj [Kujbyšev Early] proved productive, early and winter hardy in the Kujbyšev province and is recommended for introduction in adjacent regions of central Povolž'e.

907 Zaltur, G. K.
(The vine variety Kalabres in Moldavia).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 3 : 42–43. [Russian].

Observations in Moldavia showed that the above vine possessed greater resistance to *Plasmopara* and *Phylloxera* than Aleppo and other dessert varieties, ripened more uniformly and had a higher sugar content.

908 Negrul', A. M.
(Evolution of the size of seeds and grapes in vines).
Izv. timirjazev. sel'skohozjajstv. Akad. (News Timirjazev agric. Acad) 1960 : No. 2 : 167–76. [Russian].

The size and shape of the seed of wild vines belonging to different ecogeographical groups of *Vitis vinifera*, including those of the seed from archeological finds in the Crimea, Central Asia and Transcaucasus, were studied. Seed length and shape and position of the chalazae proved to be distinguishing characteristics between different species and forms. Seed size was positively correlated with fruit size. Studies of the seed of wild and cultivated vines showed that evolution towards larger seeds and grapes was operative and that in cultivated vines size of seed and grapes increased progressively as a result of popular selection in all places of their origin in Europe and Asia. These increases were the least significant in the dessert vines from Transcaucasia which have been in cultivation there since the Eneolithic age.
The seed of dessert type which has been excavated in Central Asia is of a more recent date. It is concluded that the dessert vines originated in the Middle East long before the advent of Islam.

909 Ėfendeev, M. M.
(Artificial pollination of vineyards by helicopter).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1960 : No. 5 : p. 62. [Russian].

The yields of vine varieties with perfect and ♀ flowers were greatly increased on a farm in Azerbaijan by low flights of a helicopter at the time of flowering. The aircraft created air currents which drew the pollen from the flowers and caused it first to rise and then alight on the flowers.

910 Manankov, M. K.
(Utilizing growth stimulants on varieties with the female-functioning type of flower).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1960 : No. 3 : 28–33. [Russian].

Treatments of such vine varieties as Čauš and Nimrang with gibberellic acid improved their sets, reduced the number of small fruits and promoted earliness and development of parthenocarpic fruits in experiments conducted in the Crimea. The tables show minor varietal differences in response to the treatments.

911 Žuravel', M. S., Milovanova, L. V. & Frolov, A. I.
(The effect of gibberellin on berry formation in vines).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1960 : No. 3 : 33–38. [Russian].

Increases in the size of grapes accompanied by chemical changes in seedless varieties were obtained by spraying inflorescences after flowering at the Central Asiatic research station of the Institute of Plant Industry. All varieties containing seed, except Askeri, showed no response to the treatment. The increases in grape size of some sultana varieties were so remarkable that they were hardly recognizable as the same variety. Tables are given showing the increases in weight and dimensions of grapes of a few seedless varieties and Askeri after spraying with different concentrations of gibberellin. Another table shows the effects of the treatments upon the chemical properties of the berries of these varieties.

912 KAMEL, A.
Estudio sobre la sexualidad de las uvas de mesa en España. (**Studies on the sexuality of dessert grapes in Spain**).
Bol. Inst. Invest. agron., Madr. 1959 : **19** : 331–47.

Among 96 varieties, seven had apparently female flowers with stamens much reduced in size but bearing fertile pollen. Of the remainder, the variety Japinkay had apparently male but functionally hermaphrodite flowers and the other varieties were clearly hermaphrodite. Pollen fertility was high in all varieties. Japinkay was characterized by a high level of self fertilization and one group of hermaphrodite varieties produced fruits which were parthenocarpic or contained reduced seeds. Data on the fruit characters and earliness of each variety are included.

913 DARLOT, A.
L'Ouzbekistan. (**Uzbekistan**).
Bull. tech. Ing. Serv. agric. 1960 : No. 151 : 419–30.

At the Federal Institute for Plant Production and Improvement at Taškent, local vines are being crossed with *Vitis vinifera* plants of French and Italian origin, *V. labrusca* and *V. rupestris*, the last two species being used to confer drought and cold resistance.

Breeding of early and late cottons for northern and southern regions is briefly reported; lines 59–71–1 and 2–1–3 are early, long-fibred selections.

914 GRÜNZEL, H.
Studien zur biologischen Differenzierung des Falschen Mehltaues der Weinreben (*Peronospora viticola* de Bary). [**Studies on the biological differentiation of downy mildew of vines (*P. viticola* de Bary)**].
Phytopath. Z. 1960 : **39** : 149–94.

No differences in pathogenicity on 60 *Vitis* species and cultivars, in morphology or in physiological characteristics could be detected among populations and single-spore cultures of *P. viticola* collected from the vine-growing areas of central Europe.

915 OCHS, G.
Über elf Stämme des Panaschürevirus der Weinrebe. (**On eleven strains of the vine mosaic virus**).
Phyton, Vicente López 1960 : **14** : 1–11.

Isolates from the main German vine-growing areas fell into 11 distinct strains on the basis of (1) their symptoms on vines, (2) their behaviour on inoculation on test plants, (3) their serological behaviour and (4) their transmissibility by five *Cuscuta* species, *Myzus persicae*, *Otiorrhynchus sulcatus* and three nematode species. Electron microscope studies revealed no differences.

916 ALLEWELDT, G.
Die Beziehungen zwischen photoperiodischer Reaktion und Gibberellinsäure-Empfindlichkeit bei Reben. (**The relationships between photoperiodic reaction and sensitivity to gibberellic acid in vines**).
Z. Pflanzenz. 1960 : **43** : 63–84.

Observations on a number of *Vitis* species and hybrids showed them all to be retarded by short photoperiod but some much more so than others; they also differed in the degree to which the effect of short photoperiod was annulled by supplying red light in the dark intervals. Gibberellic acid also annulled the effect in the less sensitive varieties such as Sylvaner and Riesling but not in the highly sensitive ones such as Kober 5BB, Rupestris St. George and the American species. The hybrids studied varied in reaction according to whether one or other parental type was dominant. There is no indication that the reaction is affected by the rootstock.

The most likely explanation for the effect of gibberellic acid is that it combines with a hypothetical substance, referred to as the "third factor", supposed to be present in varying amounts in different varieties, forming a complex which, together with an inhibitor developed in short days and with heteroauxin, determines the growth of the plant. If this third factor could be identified it might prove possible to determine the photoperiodic reaction of a single plant by analysis of its content of third factor.

FOREST TREES

Proceedings of the Sixth Meeting of the Committee on Forest Tree Breeding in Canada. Montreal, August 17th-19th 1958. Part II. Reports and papers. (Mimeographed).

917 *Cram, W. H. 1957 report on breeding and nursery research.* (*pp. B1–B6*).

At Indian Head, Sask., the albino and pendant characters in *Caragana arborescens* have been shown to be determined by simple, recessive and independent factors. Seven self-incompatible selections have been found.

918 *Heimburger, C. Summary of report on forest tree breeding in 1957. (pp. F1–F4).*
Numerous interspecific crosses of white pine have been made. One population of *Pinus strobus* x *P. peuce* has shown very low incidence of blister rust in both 1956 and 1957.

919 *Hutchinson, A. H. The cyto-operative system basic to the binary frequency distribution of multiple factors—polygenic alleles. (pp. I1–I2). (Abst.).*
[Cf. XXIX, 1008].

920 *Hutchinson, A. H. & Sweet, H. Cytological studies in chromosomes and plastids in Douglas fir. (p. I2). (Abst.).*
"Studies of leaf buds of Douglas fir show definite individuality of chromosomes and under varying cultural conditions aberrations occur in a number of chromosomal structures suggesting translocation and polysomaty."

921 *MacGillivray, H. G. Report on tree improvement work at the Acadia Forest Experiment Station, 1957–58. (pp. J1–J3).*
Tents of pillow ticking used in isolating balsam firs are described.

922 *Moore, R. J. Cytogenetic studies in* Caragana, *1958. (pp. K1–K2).*
Tetraploids ($2n = 32$) of *C. arborescens* have been developed by means of colchicine treatment of a diploid. Observations on the narrow-leaved, narrow-flowered, usually seed-sterile form *C. arborescens* f. *lorbergii* and its crosses with typical *C. arborescens* suggest that (*a*) the *lorbergii* character is determined by an incompletely dominant gene, *L*, (*b*) the peripheral tissue of f. *lorbergii* has the genotype *Ll*, while the core has the normal *arborescens* genotype *ll*, and (*c*) the gametes are formed from the heterozygous tissue. Crosses with typical *arborescens* give two types of progeny, viz. typical *arborescens* (*ll*) and plants which are variable and intermediate between *lorbergii* and *arborescens* (*Ll*). When open-pollinated, presumably by adjacent *lorbergii* bushes, the self-sterile flowers of the *lorbergii* form produce the above classes of progeny and also a third, described as super-*lorbergii* and believed to consist entirely of *Ll* tissue.

923 *Mergen, F. Forest tree breeding and genetics at Yale University. (pp. Q7–Q10).*
The following work by J. R. McWilliam on pollination, pollen germination and interspecific incompatibility in *Pinus* is reported. In all the crosses studied, pollen grains reached the nucellus. Incompatibility between some species appears to be incomplete, suggesting that reproductive isolating mechanisms are still evolving in the genus, a process which has been accelerated by geographical isolation. Chemical differences between the ovules of different species appear to affect the ability of the pollen of one species to germinate or function effectively in the nucellus of another, causing breakdown of the gametophyte and ultimate collapse of the ovule.

924 *Mergen, F. Natural polyploidy in slash pine. (pp. R1–R6).*
Five abnormal seedlings of *Pinus elliottii* collected in the Florida State Nursery at Olustee proved to be mixoploids, three with diploid and tetraploid cells only and two with triploid cells also.

925 *Kriebel, H. B. Geographic differentiation in seed dormancy and juvenile growth rate of Ontario sugar maple. (pp. R7–R11).*
Differences in time and rate of seed germination and growth in the first year were found among seed samples from widely separated sources in Ontario. Indications were also found of a linear relationship between height of one-year-old offspring and height of seed parent.

926 *Yeatman, C. W. A tree crown isolation tent. (pp. R19–R20).*
The use of pillow ticking or fine white cotton sailcloth in making tents in which the crowns or parts of the crowns of spruces have been successfully isolated is described.

927 *Dorman, K. W. The status of work on wood quality in southern forest tree improvement research. (pp. S1–S15).*
This is a review of work on variation and inheritance of quality in wood for pulping.

928 *Perry, T. O. & Wang, C.-W. Investigations of variation in wood quality of southern pines and its genetic significance. (pp. S17–S29).*
On the basis of a survey of work on variation in specific gravity in various pine species, the possibilities of increasing dry pulp yield by selection are discussed.

Abstracts of semi-formal research papers in forest genetics.

Proc. Soc. Amer. For. 1959 (1960) : 38–40.

The following papers were read at a meeting of the Western Forest Genetics Association held at the Institute of Forest Genetics, Placerville, Calif., on 14 November, 1959.

929 *Barnes, B. V. Natural variation of* Populus tremuloides *and* P. grandidentata *in northern Lower Michigan.* (*p. 38*).
[Cf. 946].

930 *Callaham, R. Z. Geographic variation in growth response of ponderosa pine.* (*p. 38*).
Strong geographic and genetic differences which could be correlated with differences in climate were found for the following physiological characters in seedling half-sib progenies: germination rate and capacity at 8, 16, 24, 30 and 36° C.; growth responses under nine combinations of day temperatures of 30, 23 and 17° C. with night temperatures of 22, 14 and 7° C.; and growth under 16-hour, 12-hour and 8-hour photoperiods.

931 *Campbell, R. K. Variations in crown form attributes in population of Douglas-fir.* (*pp. 38–39*).
In samples from ten environmentally distinct areas in south-western Washington, large variations within samples and significant differences between areas were found for angle, length, diameter and number of branches. It was not discovered whether these phenotypic differences were also genetically determined. About 36% of the explainable variation in the volume of stem sections seven whorls in length was associated with corresponding variation in the total cross-sectional area of the base of branches inserted in the section. About 37% of the stem-volume variation could not be associated with variation in the crown characteristics.

932 *Ching, K. K. & Bever, D. N. Provenance study of Douglas-fir in the Pacific Northwest region. I. Nursery performance.* (*p. 39*).
Measurements and observations made in the Oregon State Nursery, Corvallis, revealed significant differences in height growth and needle length among seedlings from 14 areas ranging from southern Oregon to British Columbia. Flushing was significantly earlier in seedlings of the southernmost provenance than in other seedlings.

933 *Ebell, L. F. & Schmidt, R. L. Effect of elevation and climatic factors on production and dispersal of coniferous tree pollen.* (*p. 39*).
Among ten species pertaining to six genera, growing on Vancouver Island, onset of flowering was delayed with increasing altitude but pollen production did not appear to decrease, indicating that incomplete pollination is unlikely to be the cause of poor seed set and seed quality at high altitudes.

934 *Kriebel, H. B. Timing of pollen application in relation to seed in* Pinus strobus. (*p. 39*).
Pollen was applied to ♀ strobili at various stages of development, several female parents and several species of pollen being used. Cone and seed set per pollinated strobilus increased with stage of development. The ratio of filled to total seed varied with pollen species but was unrelated to total seed yield or time of pollination. Cone and total seed set were not dependent on pollen species. Some ♀ flowers are receptive prior to the opening of the bud scales, indicating that for controlled pollination, strobili should be isolated before the buds become swollen.

935 *Perry, T. O. Kinds of racial variation and their significance.* (*p. 40*).
In studies of *Pinus elliottii*, *P. taeda*, *Acer rubrum*, *Tsuga canadensis*, *Betula papyrifera* and *B. alleghaniensis*, conducted at the University of Florida and the California Institute of Technology, it was found that trees of varying provenance (*a*) make their optimum growth at different day and night temperatures and (*b*) differ in their winter chilling and photoperiod requirements. These differences are closely correlated with the environmental conditions at the original localities of the trees.

936 *Squillace, A. E. & Bingham, R. T. Heritability of juvenile growth rate in western white pine.* (*p. 40*).
Data were obtained on height growth rates in four-year-old progenies produced by controlled and wind pollination, and in their parents, and progeny-parent correlations were computed after choosing appropriate crosses to represent several mating schemes; heritability estimates were calculated from these. Estimates were also made from progeny data alone, by methods involving "components of variance". The estimates, which are of a preliminary nature, are stated to have varied from –8 to 21%. Assuming a heritability of 10% for this character, the authors found that, in a seed production area where 5% of the trees are retained, the expected gain would be about 4%, while with selection and progeny testing of 75 trees, followed by establishment of clonal orchards from the best 15, first generation gains may be about 20%.

937 Andersson, E.
Fröplantager i skogsbrukets tjänst. **(Seed orchards in the service of forestry).**
K. Skogs- o. Lantbruksakad. Tidskr. 1960 : **99** : 65–87.

A national programme for the establishment of seed orchards of *Pinus sylvestris*, *Picea abies*, larch and, to a lesser extent, oak, beech, Douglas fir, *Pinus contorta*, *P. cembra* and *Picea omorika* has been initiated in Sweden. The following types of orchard are described: (1) plus tree orchards, in which plus trees of the same species and provenance are crossed; (2) provenance orchards, containing trees of the same species but varying provenance; (3) orchards for interspecific hybridization, in which different but cross-compatible species are grown together; and (4) élite orchards, containing trees of known genotype which have undergone clonal and progeny tests. Seed orchards of type (1) have been established for pine, spruce, oak and beech, and type (3) for larch. Type (2) orchards are used for the production of vigorous hybrids between trees of varying provenance, and, as regards spruce, include material from Poland and neighbouring parts of Russia which grows rapidly, flushes late and shows excellent resistance to autumn frosts. Orchard types (1), (2) and (3) are planned so as to allow for thinning on the basis of information from clonal and progeny trials. Clonal trials reveal genetical differences between clones in flowering habit, seed development, branching angle, branch length, branch diameter, height and wood quality. In this connexion, it is noted that northern Swedish pine races have shown greater resistance to *Phacidium* than southern Swedish races. For progeny testing a diallel crossing system gives the most informative results but various less complete crossing systems are less costly; these and suitable layouts are discussed.

938 Boom, B. K.
Benaming, geschiedenis en kenmerken van een aantal houtachtige planten. II. **(Nomenclature, history and characteristics of a number of woody plants. II.).**
Meded. Inst. Vered. TuinbGewass. 1959 : No. 157 : 85–176.

This second descriptive list of cultivars of ornamental woody plants grown in the Netherlands [cf. XXVII, 4502] includes species from the following genera: *Acer*, *Picea*, *Populus*, *Prunus*, *Quercus*, *Robinia*, *Salix*, *Sorbus* and *Ulmus*. The cultivars *Acer pseudoplatanus* 'Negenia' and 'Zenith' are described as suitable for timber production in road-verge plantings. Latin diagnoses are given for the interspecific hybrids *Picea mariorika* (*P. mariana* x *P. omorika*) and *Quercus libanerris* (*Q. cerris* x *Q. libani*), both of which are intermediate between their parents; the oak hybrid has been sterile up to now. *Robinia pseudacacia* 'Appalachia' is a straight-growing tree suitable for forestry. *Ulmus hollandica* 'Commelin', from a cross between a seedling and the Huntingdon elm, shows good resistance to *Ceratostomella ulmi*.

939 Holzer, V. K. & Liebeswar, K.
Eine einfache kulturkammer für Sämlingsprüfung mit Nährlösungskultur. **(A simple growth chamber for seedling tests with nutrient solution culture).**
Silv. genet. 1960 : **9** : 17–20.

The culture chamber described is especially designed for growing seedlings of forest trees and examining their development during the first season. The seedlings are provided with artificial light of about 10,000 Lux, kept at almost constant temperature and grown in pure quartz sand. The nutrient solution and the air in the substrate are changed by means of a pumping device. In this chamber three or four tests may be carried out each year and the chamber will hold 8,000 seedlings; it is divided into four compartments so the growth of seedlings treated with different photoperiods may be compared, other conditions being equal.

940 Klaehn, F. U. & Neu, R. L.
Hardwood pollen study.
Silv. genet. 1960 : **9** : 44–48.

The morphology of the pollen grains of *Populus tremuloides*, *Prunus serotina*, *Ulmus americana* and *Betula papyrifera* is described. Germination tests were carried out, and it was found that an agar medium with 10% sucrose was satisfactory for pollen of *P. tremuloides* and *P. serotina*. Under identical conditions, the pollen of the two other species either did not germinate at all (*Ulmus americana*), or only to a very limited extent (*B. papyrifera*). The unfavourable location of the flowers from which the pollen was obtained is suggested as the main reason for the results in the last two species. A positive correlation was obtained between the percentage of pollen grains which germinated and the growth of the pollen tube, but no significant relationship was found between the length of tube and the delay in initiation of germination.

941 Scholz, E.
Blütenmorphologische und -biologische Untersuchungen bei *Acer pseudoplatanus* L. und *Acer platanoides* L. **(Studies on floral morphology and floral biology in *A. pseudoplatanus* L. and *A. platanoides* L.).**
Züchter 1960 : **30** : 11–16.

Considerable diversity of form was observed in flowers of both species. In addition to normal hermaphrodite flowers, there were flowers in which the female organs were suppressed in varying degrees and in others the anthers were shrivelled. Completely male flowers also occurred. Trees differed in the types of flowers produced. Some trees showed variation from year to year in the proportions of the different types of flower produced and in others there appeared to be no variation. In *A. pseudoplatanus*, the evolution of dieciousness seemed to be more advanced than in *A. platanoides*. Trees with only male flowers grew better than those of mixed sex.

942 Schönbach, H.
Einige Ergebnisse achtjähriger Züchtungsversuche mit Pappelarten der Sektion *Leuce*. **(Some results of eight years' breeding experiments with poplar species of the section *Leuce*).**
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1960 : No. 44 : 7–21.

It was found that, in general, populations with rapid juvenile growth have good stem form and slow growing types unsatisfactory stem form. Many interspecific and intraspecific crosses have been studied at Tharandt and progenies with good form were found amongst crosses between local aspens and aspens from north and northeast European provenances. A tendency to produce short stems and much branched crowns was found to be a specific character of *Populus alba* which is more or less dominant in the F_1 of crosses with *P. tremula*. In some crosses between *P. tremula* and *P. tremuloides*, a high proportion of the progeny showed a shrubby habit; the proportion of *pendula* forms produced in aspen crosses depended on the genotypes of the parents and the environment. All crosses between local and north or northeast European aspens yielded progeny with a reduced vegetative period and consequently smaller growth increment. Amongst the local aspens individuals with good combining ability were found which produce offspring equalling the northern types in form and with superior growth rate when young. In some cases the phenotype gave no indication of breeding value. Broad-crowned aspens bear more flowers and fruit than those of better form.

943 Bondarenko, N. I.
(The hybridization of poplars and willows employing rooted branches).
Les. Hoz. (Forestry) 1960 : No. 8 : 33–34. [Russian].

The common Soviet breeding method has been modified by rooting cut branches of *Populus* and *Salix* spp. previous to interspecific crossing in the glasshouse. This ensures an increased flow of nutrients to the reproductive organs until the seed ripens. The seed and pollen parents used for interspecific hybridization of poplars and willows are listed, the pollen in both cases including mixtures of two or more different species. Among the successful crosses of poplars were those from pollination of *Populus pyramidalis* and *P. nigra* by *P. berolinensis*, *P. nigra* by *P. pyramidalis* and *P. nigra* and *P. pyramidalis* by a pollen mixture comprising several species.

944 van Buijtenen, J. P., Joranson, P. N. & Einspahr, D. W.
Naturally occurring triploid quaking aspen (*Populus tremuloides*) in the United States.
Proc. Soc. Amer. For. 1957 (1958) : 62–64.

Natural triploids of *Populus tremuloides* with larger leaf and tree size than diploids have been found in Minnesota, Ottawa and Colorado. A study of the triploids and comparable diploids in the Ottawa area revealed that the triploids had a greater average annual volume growth and greater tracheid length, diameter and wall thickness.

945 van Buijtenen, J. P.
A technique for fixing and staining mitotic chromosomes in aspen.
For. Sci. 1959 : **5** : p. 48.

The technique described is a modification of La Cour's acetic orcein method, the stain used being acetocarmine. It has been successful for the determination of the approximate chromosome number for the purpose of distinguishing triploids of *Populus tremuloides* from diploids.

946 Barnes, B. V.
Natural variation and clonal development of *Populus tremuloides* and *P. grandidentata* in northern lower Michigan.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–4882 : 1511–12. (Abst.).

The clonal habit of growth was found to be typical of both species on two sites in lower Michigan. A wide range of interclonal variation was observed in morphological and physiological characters. Interclonal disparities in such characters as sex expression, time of flushing, autumn leaf coloration and leaf morphology were sufficiently great to permit members of one clone to be distinguished from those of a neighbouring clone of the same species. Clones whose features closely resembled about 16 previously described subspecific taxa were found on the two sites. Two clones of *P. alba* x *P. tremuloides*, one of *P. alba* x *P. grandidentata* and 33 of *P. grandidentata-tremuloides* were discovered.

947 SCHÖNBACH, H.
Ergebnisse weiterer Untersuchungen über Cellulosegehalt und Rohwichte Graupaer Pappelklone. (**Results of further investigations on cellulose content and density of Graupa poplar clones**).
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1960 : No. 44 : 81–98.

Investigations reported earlier [cf. XXIX, 4486] were continued on six and seven year old seedlings. Significant differences in cellulose content and density were found between clones; *Populus berolinensis* had the highest cellulose content and *P.* x *euamericana* cv. *robusta* the highest density. The results indicate that an early assessment of these properties is possible if the trees are raised under uniform conditions. Questions relating to breeding poplars rich in cellulose are discussed and varieties are recommended for pulp production.

948 CORRELL, D. S.
A new cottonwood from Texas.
Wrightia 1960 : **2** : 45–47.

A diagnosis and figure are given of the newly discovered Texan species, *Populus hinckleyana*.

949 MORGENEYER, W.
Über Spätfrostschäden im Pappelsortenregister Graupa im Frühjahr 1959. (**Late frost damage in the poplar variety collection at Graupa in spring 1959**).
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1960 : No. 47 : 43–56.

After frost on the night of 20 April 1959, it was found that 79% of the clones of the sections *Tacamahaca* and *Tacamahaca* x *Aigeiros* were damaged and only 37% of those of the *Aigeiros* section. *P. robusta*, two Jacometti clones, *P. trichocarpa* 'Petrowskyana' and 'Przschewalskij', Ivantejew (*P. suaveolens* x *P. berolinensis*) and Podmoskowskij (*P. suaveolens* x *P. tremula*) showed no or very slight injury. With the exception of *P.* x *generosa* and two *angulata* hybrids, growth was very little affected by the damage. Although many clones which come into leaf early escaped damage, some were susceptible to frost and it is concluded that morphological and physiological characters of leaves and shoots as well as time of leafing play some part in determining resistance to late frost.

950 MORGENEYER, W.
Beobachtungen über Frostschäden und *Cytospora*-Befall in Pappelsortenregister in Graupa nach der anomalen Witterung der Winter 1954/55 and 1955/56. (**Observations on frost damage and *Cytospora* attack in the poplar variety collection in Graupa after the anomalous weather of the winters 1954-55 and 1955-56**).
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1960 : No. 44 : 23–49.

Weather during the above winters was particularly unfavourable and much damage was caused by frost, *C. chrysosperma* and *C. nivea*; this damage was assessed without distinguishing between that caused by frost and that caused by fungal attack. On the whole varieties and forms of section *Aigeiros* suffered more than those of the *Tacamahaca* section but in both groups there were some forms showing no or little damage. *P.* x *euramericana* cvv. *robusta*, *bachelieri*, *vernirubens* and *regenerata* were severely attacked and *P.* x *euramericana* cvv. *serotina* and *marilandica* and *P. trichocarpa* were only slightly damaged. Other forms including *P.* x *berolinensis* were intermediate in this respect. *P. fremontii*, *P. wislizenii*, the Maine poplar, the Andover poplar and some clones from Waldsieversdorf were completely free of damage.

951 SCHÖNBACH, H. & SCHEUMANN, W.
Bestimmung der Zellsaftkonzentration von Pappelblättern mit Hilfe des Refraktometers. Ein Beitrag zur Entwicklung von Serienuntersuchungsmethoden für die Selektion dürreresistenter Formen forstlich interessierender Baumarten. (**The determination of the cell sap concentration of poplar leaves with the help of the refractometer. A contribution to the development of mass investigation methods for the selection of drought resistant forms of tree species interesting for forestry**).
Züchter 1960 : **30** : 83–87.

Determinations of cell sap concentration were made for hybrids of *Populus tremula* on 23 June, 8 July and 25 July 1959; May and June of that year were very dry but heavy rain fell in July. The hybrids differed markedly in the changes in cell sap concentration shown during the testing period and in the highest value reached. It is thought that such results may be of use in determining reaction to drought.

952 LOGAN, L. A.
An ecological study of the American beech along the southwestern border of its distribution.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–6378 : p. 3487. (Abst.).

An examination of herbarium specimens from the entire ecological range in the USA revealed two distinct varieties, namely var. *caroliniana* in the extreme southern range, and var. *grandifolia* in the New England states.

953 DUMITRIU-TATARANU, I.
Origine et position systématique des îlots de hêtre du sud-est de la France. (**Origin and systematic position of the isolated stands of beech in the south-east of France**).
Rev. for. franç. 1959 : **11** : 199–213.

Among beech populations at Valbonne, Sainte-Baume and Bedoin, trees with cupule, flower and leaf characters resembling those of forms intermediate between *Fagus sylvatica* and the east European species *F. orientalis* are found. *F. orientalis* occurs in tertiary remains and is regarded as an ancestor of *F. sylvatica*. It is argued that, while in some areas such intermediate forms may be the result of hybridization, in France they probably represent a survival from the evolution of *F. sylvatica* from *F. orientalis*.

954 PEACE, T. R.
The status and development of elm disease in Britain.
Bull. For. Comm., Lond 1960 : No. 33 : Pp. 44.

This detailed account of the behaviour of *Ceratocystis ulmi* in Great Britain includes information on the variability of the pathogen and on differences in susceptibility of the various types of elm. While definite resistance has been established for such eastern species as *Ulmus pumila* and *U. wallichiana*, none of the numerous forms of elm commonly occurring in Great Britain are known to be resistant.

955 HIGGINS, D. J.
The utilization of glucose carbon by five isolates of the fungus *Ceratocystis ulmi*.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–748 : p. 3485. (Abst.).

A strain of *C. ulmi* capable of infecting an *Ulmus carpinifolia* variety previously considered to be resistant was found to differ from the other isolates in "total acidity" and in percentage of carbon in the nonvolatile acid category.

956 BARLOW, B. A.
Chromosome numbers in the *Casuarinaceae*.
Aust. J. Bot. 1959 : **7** : 230–37.

Chromosome numbers of 37 *Casuarina* species are reported. Species within the *Cryptostomae* appear to fall into two natural groups, a smaller one which includes the Malaysian and a few Australian species, and a larger group which is entirely Australian; these two are here referred to as group A and group B respectively. In section *Gymnostomae*, $2n = 16$. Within section *Cryptostomae*, $2n = 18$ (group A); $2n = 20$, 24, 26, 28, 39, 44 and 56 (group B); and $2n = 22$, 33 and 44 (*distyla* group).

957 BARLOW, B. A.
Polyploidy and apomixis in the *Casuarina distyla* species group.
Aust. J. Bot. 1959 : **7** : 238–51.

"A hypothesis is presented that polyploidy and apomixis have arisen together within the species through establishment in a diploid population of a triploid plant which is diplosporous and parthenogenetic. The genetic system involved probably spread through the group during the evolution of the species, giving them a potential for this kind of development."

[From Author's Summary].

958 PRYOR, L. D.
A hybrid swarm between *Eucalyptus odorata* Behr. and *Eucalyptus leucoxylon* F. Muell.
Trans. roy. Soc. S. Aust. 1955 : **78** : 92–96.

Observations on floral and foliar characters have revealed the existence of a hybrid swarm between the above two species near Burnside, S. Australia. The putative hybridity of the intermediate types was confirmed by a biometrical study of the leaves of their progeny.

959 BODEN, R. W.
Handling and storage of pollen in eucalyptus breeding.
Aust. For. 1958 : **22** : 73–81.

Use of 1·5% gelatine in 20% sucrose as medium, with an incubation period of 6 hr. at 30° C., was adopted as the standard procedure for *in vitro* germination of pollen. A direct correlation exists between germination *in vitro* and *in vivo*, as indicated by data on *E. pulverulenta*. Intraspecific variability in pollen production and germination percentage in each species studied was wide. Pollen abundance and germination were not however associated. Within individual trees, variation in germination percentage at different times during the flowering period, as well as in two consecutive years, was negligible. Deep-freeze storage of pollen at − 16° C. was successful. Hints are given on field collection and transport.

960 KLEVCOV, V.
(In the laboratory of an academician).
Les. Hoz. (Forestry) 1960 : No. 6 : 80–81.
[Russian].

A brief report on the Forestry Laboratory of the Academy of Sciences is given. It mentions economically valuable hybrids of forest trees bred by Sukačev, in particular new forms of willows which are being utilized for checking drifting sands and preventing soil erosion on steep slopes.

961 RUDINSKY, J. A. & VITÉ, J. P.
Certain ecological and phylogenetic aspects of the pattern of water conduction in conifers.
For. Sci. 1959 : **5** : 259–66.

"The ecological and phylogenetic significance of five water-conducting systems is discussed. The criterion used was whether the water ascending through a given sector of the lower tree stem is distributed to a small portion or to a rather large portion of the transpiration surface. Thus, the sectorial, straight ascent and limited distribution of water in certain Cupressaceae is considered to be less effective than the interlocked ascent of water with considerable distribution over a large portion of the transpiration surface, which is present in other genera of the same family. The most complete distribution, however, is exhibited by a system of spiral ascent with great winding momentum, which is common in genera of Pinaceae (spiral, right-turning ascent). In the same family two genera (*Tsuga* and *Pseudotsuga*) show an intermediate structure in their water-conducting system. This system still bears the feature of sectorial ascent, but it provides more extensive water distribution by a semi-spiral arrangement of the tracheidal conduits in adjacent growth layers. Striking differences in the water-conducting systems within the genus *Pinus* confirm the genetic diversity indicated by other workers."
[Authors' summary].

962 SCHÜTT, P.
Züchtung mit Kiefern. Teil I. Individualunterschiede und Provenienzversuche. **(Pine breeding. Part I. Individual differences and provenance trials).**
Mitt. BundForschAnst. Forst-u. Holzw. Reinbek b. Hamburg 1958 : No. 40 : Pp. 65.

This review is divided into the following chapters: (1) introduction; (2) biology of the reproductive organs, with sections on flowers, cones, seeds and age of mother tree; (3) inheritance of morphological characters, with sections on growth, trunk form, crown form, branching, wood properties, and other morphological characters; and (4) inheritance of physiological properties, with sections on resin production, photoperiodic response, and provenance tests in different species. Numerous references are listed in each section.

963 THULIN, I. J.
Application of tree breeding to New Zealand forestry.
Tech. Pap. For. Res. Inst. NZ 1957 : No. 22 : Pp. 12.

Breeding has so far been concerned chiefly with *Pinus radiata* and has involved selection and vegetative propagation of plus trees and testing of clones and progenies of the selected material. Provenance trials of other introduced conifers have been carried out.

964 WRIGHT, J. W.
Species hybridization in the white pines.
For. Sci. 1959 : **5** : 210–22.

A report is given on the results of ten years' work on hybridization between five-needled species at the Northeastern Forest Experiment Station, USA. Including reciprocals, 38 interspecific combinations were attempted, of which 16 are regarded as successful or probably successful. The following combinations are among the most promising: *P. flexilis* x *P. griffithii*, *P. griffithii* x *P. strobus*, *P. ayacahuite* x *P. griffithii*, *P. ayacahuite* x *P. strobus*, *P. strobus* x *P. griffithii* and *P. strobus* x *P. ayacahuite*. They have grown faster than seedlings of either parent species in the nursery and given maximum seed yields of 22·0, 9·3, 24·3, 21·2, 6·2 and 13·0 filled seeds per cone, respectively.

965 BANNISTER, M. H.
Evidence of hybridization between *Pinus attenuata* and *P. radiata* in New Zealand.
Tech. Pap. For. Res. Inst., NZ 1958 : No. 13 : 1–9.
[Cf. XXIX, 776].

966 BANNISTER, M. H.
Variation in two-year-old *Pinus attenuata*, *P. radiata* and their hybrids.
Tech. Pap. For. Res. Inst., NZ 1958 : No. 13 : 11–20.
[Cf. XXIX, 777].

967 ROSSMÄSSLER
Die Hauptanbaugebiete und Rassen der Kiefer in Hessen. (**The main areas and races of pine in Hesse**).
Forst. u. Holz. 1959 : **14** : No. **4** : 69–73.

Two main types of *Pinus sylvestris* are recognized in Hesse, Germany. One, occurring at altitudes of 300–500 m., is slow growing and has a pyramidal crown, while the other, growing below 300 m., grows rapidly and has a crown which branches broadly at the top. These phenotypes have been maintained in 30-year-old provenance trials conducted in various districts.

968 THÜMMLER, K.
Beobachtungen an 6jährigen Nachkommenschaften frei abgeblühter Einzelstämme von *Pinus contorta* Douglas (*Pinus Murrayana* Balfour) verschiedener Herkünfte. [**Observations on six-year-old progenies of open-pollinated single trees of *P. contorta* Douglas (*P. Murrayana* Balfour) of differing provenance**].
Arch. Forstwesen 1958 : **7** : 862–73.

Single-tree progenies from four regions, two in Alberta, one in Saskatchewan and one in British Columbia, were grown in Frauenstein, East Germany. At the age of six years, progenies from Saskatchewan showed the best growth and those from southern Alberta the poorest, but the latter were best in branching habit and had the lowest frequency of Lammas shoots, although other progenies showed less variation in this character. Flowering was most abundant in trees of northerly or continental provenance.

969 HUART, A.
L'absorption d'oxygène par des graines de pin sylvestre (*Pinus sylvestris*) de diverses provenances. [**The oxygen absorption of Scots pine seeds (*P. sylvestris*) of diverse provenance**].
Agricultura, Louvain : Sér. 2 : 1957 : **5** : 3–13.

The oxygen consumption of whole or ground seeds, as determined by means of the Warburg technique, was progressively lower for pines of the following provenance: France (44° 58′ N.), Scotland (57° N.), Belgium (51° N.) and Sweden (65° 42′ N.). This result is in harmony with the view that pines in Belgium are of northern origin. It is thought that oxygen consumption may prove to be a useful character in testing material for its adaptive value in a given locality.

970 LEIBUNDGUT, H.
Beitrag zur Rassenfrage bei der Schwarzföhre. (**Contribution to the question of races in black pine**).
Cbl. ges. Forstw. 1958 : **75** : 197–202.

Seedlings of *Pinus nigra* from 14 different locations in Yugoslavia, Italy, Corsica and Austria (latitudes 39–48° N. and altitudes 150–1400 m.) were grown under 8 hr. and 16 hr. photoperiods and continuous light. Little difference in hypocotyl length was detected between provenance samples, but when altitudes were all reduced to the equivalent altitude at 48° N., the largest hypocotyls were found in material from the highest altitude. Slight differences in photoperiodic response were detected between some localities.

971 SANTAMOUR, F. S. (JUN.)
New chromosome counts in *Pinus* and *Picea*.
Silv. genet. 1960 : **9** : 87–88.

A chromosome number of $n = 12$ is reported for seven species of *Pinus* and for 11 species of *Picea*, all previously unreported. They are *Pinus armandi*. *P. ayacahuite*, *P. cembra*, *P. edulis*, *P. griffithii*, *P. koraiensis*, *P. monticola*; and *Picea asperata*, *P. balfouriana*, *P. bicolor*, *P. engelmannii*, *P. jezoensis* var. *hondoensis*, *P. koyamai*, *P. maximowiczii*, *P. montigena*, *P. omorika*, *P. orientalis* and *P. rubens*. The species are among those being utilized in hybridization work at the Northeastern Forestry Experiment Station in Pennsylvania. Observations made on chromosome morphology agree, in general, with previous findings.

972 McWilliam, J. R.
Effect of temperature on pollen germination of *Pinus* and its bearing on controlled pollination.
For. Sci. 1959 : **5** : 10–17.

By means of potentiometer readings, temperatures were recorded in the strobili of *P. elliottii* and *P. nigra* covered with several types of bags. The behaviour of the pollen under these conditions was predicted from *in vitro* observations on germination and tube growth. During hot sunny weather, lethal temperatures (above 46° C.) occurred in strobili on exposed portions of the crown, when enclosed in sausage-casing bags. By protecting these bags from direct insolation, particularly with some type of reflecting paint, temperatures approaching those in uncovered strobili may be maintained.

973 Barber, J. C., Dorman, K. W. & Bauer, E.
Slash pine progeny tests indicate genetic variation in resistance to rust.
Res. Note S.E. For. Exp. Sta. 1957 : No. 104 : Pp. 2.

Mother trees were selected for growth rate, trunk and crown form and freedom from rust cankers from a stand near Clupley, Ga., showing 75% infection by *Cronartium fusiforme*. Open-pollinated progenies were planted out in 1952 and 1953 and examined for rust infection in 1955. Some progenies showed a low percentage infection, the average for progenies from nine mother trees being 30–33% less than that for control seedlings from unknown parent trees. The progenies of one tree had less than half as much infection as the controls and in addition were among those with the most rapid growth.

974 Bingham, R. T., Squillace, A. E. & Wright, J. W.
Breeding blister rust resistant western white pine. II. First results of progeny tests including preliminary estimates of heritability and rate of improvement.
Silv. genet. 1960 : **9** : 33–41.

Different mating and progeny-testing techniques for the improvement of rust resistance in the western pine have been studied. The progenies used were grown for two years in a nursery in Washington, and were artificially inoculated with rust sporidia. Subsequently they were transferred to Idaho and Montana and four years later were examined for the presence or absence of the rust fungus. It was found that the optimum gains in rust resistance (26·8 to 30%) were possible through genotypic selection, i.e. where the parents were selected for specific or general combining ability on the basis of progeny tests. In contrast to this, the gains realized through phenotypic selection, or from crossing untested phenotypes, were small (4·0% and 12·6% respectively). Heritability of rust resistance was calculated for four different groupings of related progenies. In the most reliable test, heritability in the narrow sense was 0·688 (68%), and in the broad sense 0·869.

The authors have reached certain tentative conclusions regarding breeding methods. It is stated that 25–30 clones are the minimum numbers of parents needed to prevent loss of vigour through inbreeding. Tests with wind-pollinated progenies may have to be 3–4 times as large as those where artificial pollination is used. The most practical way of improvement is by means of early-generation selection for general combining ability. This permits the exploitation of current gains, while making simultaneous gradual progress towards substantially increased resistance. Models are presented which help to predict the genetic gain per generation. Possible methods for increasing rates of gain are also discussed. It is stated that the establishment of nurseries with grafts of progeny-tested parents may be feasible in the near future. Such nurseries could be the means of producing at least partially resistant planting stock for meeting immediate needs.

975 Scholz, E.
Befallsunterschiede und Resistenz be *Pinus strobus* gegen *Cronartium ribicola* Dietr. = *Peridermium strobi* Kleb.
(Differences of attack and resistance in *P. strobus* to *C. ribicola* Dietr. = *P. strobi* Kleb.).
Züchter 1960 : **30** : 61–72.

Observations were made on trees which had been growing near Eberswalde for 20 years; they originated from open-pollinated seed from 10 German and 26 American localities. The provenance types differed with respect to the number of individuals attacked by *C. ribicola*. Marked differences in susceptibility were also noted within provenance types, some single line progenies being free of attack. Infection tests with aecidiospores were carried out in the greenhouse and grafted progenies and four-year old seedlings were tested in the field using *Ribes* sp. as sources of infection; some plants were not attacked. Technical problems of resistance testing are discussed in relation to the results of these experiments. Since the pathogenicity of the fungus is affected by the microclimate, the plants to be tested should be grown on even ground.

976 GABRIEL, W. J.
The possibilities of developing strains of white pine resistant to white-pine weevil (*Pissodes strobi*).
Proc. Soc. Amer. For. 1957 (1958) : 58–60.

Evidence of the occurrence of genetically determined resistance to weevil in geographical ecotypes and local races of *Pinus strobus* in the eastern USA was slight or inconclusive. In studies of the cross fertility with *P. strobus*, growth rate, form and probable weevil resistance of introduced white pines, the species *P. monticola*, *P. griffithii*, *P. peuce* and *P. ayacahuite* were the most promising, in the order given. It is thought that it may be possible to combine the resistance of *P. monticola* with the desirable properties of *P. strobus*.

977 GRIGSBY, H. C.
Two promising pine hybrids for the Mid-South.
Sth. Lumberm. 1959 : **198** : 32–33.

The hybrid *Pinus elliottii* x *P. mitis* shows more resistance to the tip moth *Rhyacionia frustrana* and grows faster than *P. mitis*. A single hybrid of *P. taeda* x *P. elliottii* var. *densa* has shown complete resistance to tip moth in a small-scale trial.

978 CALLAHAM, R. Z. & HASEL, A. A.
Height growth of ponderosa pine progenies.
Proc. Soc. Amer. For. 1957 (1958) : 61–62.

In extensive material studied at the California Institute of Forest Genetics, the following relationships were found. Seed size and germination time varied with year and were related to altitude of seed source, seed from lower altitudes being larger and germinating more quickly than that from high. Height growth and volume in the two-year-old seedlings were related to all the above variables, but in the 15-year-old seedlings height growth was related only to height growth in the two-year-olds, altitude of the seed source and the square of the altitude; progenies growing most in the second year and originating from the middle altitudes (2000–3000 ft.) were tallest at 15 years. Second-year height growth and its square account for 38% of the variability in height at 15 years, and second-year height growth together with altitude and its square accounts for 49%. Thus if seed is collected from optimum altitudes, selection of superior progenies may be based on height at two years.

979 MEYER, H.
Hochharzfichten für Ziele der Forstpflanzenzüchtung. **(Spruces from high parts of the Harz mountains for forest-tree breeding purposes).**
Forst u. Holz. 1959 : **14** : No. 4 : 77–78.

Analysis of the cone characters of the trees of a local stand showed that the *obovata* character was predominant, although pure *obovata* spruces were rare. The botanical variety *obovata* is particularly valuable in the area because of its resistance to snow and ice damage. The use of such types, which may be recognized by the presence of glandular hairs on the pulvinus, is recommended in breeding.

980 GOLUBEC, M. A.
(Two subspecies of *Picea excelsa* Link and the question of their geographical areas).
Bot. Ž. (Bot. J.), Moskva 1960 : **45** : 684–94. [Russian].

A study of the Carpathian spruces has shown the relative nature of many of the botanical varieties of *P. excelsa* described by previous authors; they have therefore been combined into two subspecies, ssp. *acutesquamata* and ssp. *obtusesquamata* respectively. The latter subspecies is the more valuable sylviculturally, being distinguished by greater tolerance of unfavourable growing conditions, more rapid increase in growth, more prolonged growth, deeper root system and greater longevity; it continues growth until the 45th–50th year whereas ssp. *acutesquamata* stops after 25–35 years. Though the areas of the two subspecies now overlap, they are thought to have been separate during the glacial period, ssp. *obtusesquamata* having extended towards the north-west and ssp. *acutesquamata* towards the north-east and the north in postglacial times.

981 SCHELL, G.
Keimschnelligkeit als Erbeigenschaft. **(Germination rate as a hereditary property).**
Silv. genet. 1960 : **9** : 48–53.

The property previously designated germination energy, consisting in the proportion of seeds that germinate after a given number of days, now referred to as speed or rate of germination, was studied in the seeds of 60 individual spruce trees in six different years. The germination rate proved to be a genetic characteristic of the individual trees but no correlation was found between the germination rates and the rate of growth of the tree in ensuing years, or with the size of seed or 1000-seed weight.

982 VIDAKOVIĆ, M.
Breeding of larch.
Bull. Sci. Cons. Acad. Jugosl. 1960 : **5** : p. 62. (Abst.).

Progenies from crosses between European and Japanese larches show hybrid vigour. Crosses involving tree No. 29 (origin not specified) are reported to have given progenies with a very high growth rate.

983 LANGNER, W.
Planung und erste Ergebnisse eines Japanlärchen-Provenienzversuches mit zugleich züchterischer Zielsetzung. **(The planning and preliminary results of a provenance trial of Japanese larch designed with a view to breeding).**
Cbl. ges. Forstw. 1958 : **75** : 168–96.

Provenance trials of seed collected from 25 stands in various localities in Japan have been established in Germany, other European countries, Japan and the USA. Preliminary observations in the German trials have revealed differences among provenance samples in the following characters: (1) rate and percentage of germination; (2) fresh weight, which is inversely related to altitude, although also influenced by other factors; (3) branching and general habit; (4) colour of needles and bark; (5) root formation; and (6) time of autumn change in colour, seedlings from higher altitudes generally, but not invariably, changing earlier. A good agreement between seedlings and grafts of the same provenance was observed for the last character, although grafts from different trees within a stand often differed. The occurrence of yellow and white seedlings in some provenance samples in the progeny of a seed orchard which comprised few clones and was clearly suffering from inbreeding depression, indicates that self fertility in Japanese larch occurs more frequently than has hitherto been supposed.

984 CHRISTIANSEN, H.
On the effect of low temperature on meiosis and pollen fertility in *Larix decidua* Mill.
Silv. genet. 1960 : **9** : 72–78.

In a Danish study, it was found that meiotic divisions in pollen of *L. decidua* cease when air temperatures reach a certain minimum, and are resumed when they rise again. The minimum varies from tree to tree but from refrigerator experiments appears to be 2–3° C. at metaphase I, and 1–2° C. from late prophase to diacinesis. The reasons for this low-temperature inhibition are discussed and it is suggested that the physiological processes governing chromosome movement may be suppressed, or that the viscosity of the cytoplasm becomes so high that the chromosomes cannot move. A large number of irregularities observed in both pollen mother cells and pollen grains are described. All the mature pollen in this experiment proved to be sterile, but the extent and seriousness of such damage under natural conditions is unknown. The mitotic pollen-grain divisions were not synchronized and were not completed until about a week before the discharge of pollen. If this is a normal occurrence, it limits the period during which male buds can be forced for pollen extraction.

985 BARNER, H. & CHRISTIANSEN, H.
The formation of pollen, the pollination mechanism, and the determination of the most favourable time for controlled pollinations in *Larix*.
Silv. genet. 1960 : **9** : 1–11.

An illustrated description is provided of the development of male and female inflorescences from the formation of buds to fertilization. Interruption of meiosis by low temperature and its subsequent resumption when the temperature rose were observed; these interruptions led to various meiotic irregularities. Pollen grains caught on the stigmatic flap may remain there for 5–7 weeks and are then transported to the top of the nucellus where they germinate by fluid exuded into the micropylar canal and then retracted through the top of the nucellus; the movement of this fluid is thought to be controlled by the pressure in the tissues and may be affected by climatic conditions. The effectiveness of controlled pollination may be determined by counting the pollen grains embedded in the stigmatic flaps; a preparation of the integument with the embedded pollen is made by maceration in a drop of 1 part HCl + 9 parts of acetic lacmoid or acetic orcein on a slide followed by gentle heating and squashing. Pollination is best carried out when the micropylar flaps are swollen and protruding behind heart-shaped bracts, the shape of the bracts being a more reliable criterion than the position of the bracts. The stage of development of the inflorescence may be determined by examining a bract removed from the inflorescence with the ovuliferous scale attached. It is recommended that all inflorescences should be pollinated several times at intervals of one or two days during the period of receptiveness. The female inflorescences should be isolated as early as possible.

986 Heitmüller, H.-H. & Melchior, G. H.
Über die blühfördernde Wirkung des Wurzelschnitts, des Zweigkrümmens und der Strangulation an japanischer Lärche (*Larix leptolepis* [Sieb. et Zucc.] Gord.). [**On the effect of root pruning, bending the branches and strangulation in stimulating flowering in *L. leptolepis* (Sieb. et Zucc.) Gord.**].
Silv. genet. 1960 : **9** : 65–72.

A report is given of attempts made in June 1956 to induce earlier flowering in 4-year old cuttings from 50–60-year old trees. Treated plants and controls all flowered for the first time in the spring of 1958. Marked differences in the number of flowers were noted between different plants, both treated and control. A significant increase in the number of flowers was produced by strangulation, the increase being about 4·5 times. This was significantly greater than the increases produced by the other two methods, which were not significant compared with the controls. Moreover, strangulation increased the number of both male and female flowers, whereas the other two methods reduced the number of female flowers. The same effects were observed also in the following year.

987 Ching, K. K.
Hybridization between Douglas-fir and bigcone Douglas-fir.
For. Sci. 1959 : **5** : 246–54.

Hybridization between *Pseudotsuga menziesii* and *Ps. macrocarpa* has been undertaken in Oregon with a view to combining the wood properties and rapid growth of the former species with the dry-site adaptability of the latter. The hybridity of seedlings obtained from controlled pollination in which *Ps. menziesii* figured as ♀ parent was established on the basis of growth pattern and needle morphology and anatomy. Crossability of the two species was fairly low.

988 Ching, K. K. & Bever, D.
Provenance study of douglas-fir in the Pacific northwest region.
Silv. genet. 1960 : **9** : 11–17.

Seed was collected from 14 localities on the west side of the Cascade Range in latitudes ranging from 42° 20′ N. to 49° 10′ N. and seedlings were raised at Corvallis, Ore. A correlation was found between growth in height in the second year after sowing and the place of origin of the seed; on the whole seedlings of northern provenance grew well in height. Significant differences were found between seed sources in needle length and there was some correlation between this character and height. Seedlings from seed of the southernmost provenance opened their buds significantly earlier than seedlings from the other provenances. Differences between provenance types in the time of bud development at the end of the second growing season were also noted. Seedlings from the southernmost locality, which is of high elevation, and three types from northern localities showed early bud development.

Seedlings from the seed of the Courtenay area in British Columbia had less frost damage than other seedlings.

VEGETABLES

989 North, C.
Research on vegetables at the Scottish Horticultural Research Institute.
Sci. Hort. 1959–60 : **14** : 104–09.

Trials and breeding work on Brussels sprouts, cabbage and French bean at the above institute, Mylnefield, Invergowrie, Dundee, are surveyed.

990 Philipp, F.
Ergebnisse der Gemüsesortenversuche 1958, I. (Im Rahmen der österreichischen Zuchtbuchkommission). [**Results of vegetable variety trials 1958, I. (In connexion with the Commission of the Austrian Book of Cultivated Varieties**)].
Mitt. Klosterneuburg : Ser. B. 1959 : **9** : 10–28.

Results of trials of forcing radishes and forcing lettuce are reported.

991 Rapport général 1958. Station de Recherches de l'État pour l'Amélioration des Plantes fruitières et maraîchères. (**General report 1958. State Experimental Station for the Improvement of Fruit and Market-garden Crops**). **1958** : Pp. 173. (Mimeographed).

Strawberry. A total of 47 varieties are listed according to the time required to reach maturity, and tabulated information is given on their flower and fruit production. Hybrids produced between 1952 and 1958 are also discussed; among the outstanding hybrids is A 4/24.

Onion. Two varieties selected at Gembloux, Rouge pâle de Huy [Huy Pale Red] and Jaune paille des Vertus have continued to prove satisfactory.

Spinach. Varieties which have shown greatest resistance to bolting are Géant de Vincennes [Vincennes Giant], Monstreux de Viroflay and Nobel. The hybrid H56/1 continues to show promise but its cold resistance is not yet known.

Tomato. An interesting hybrid, H2/49–1–B3/2, obtained from a cross between Econoom and Premier, is described. Other new hybrids of promise are H1/53–5–R/1 and H5/54–2/2. Moneymaker and HDB have continued to give good results in varietal trials.

French bean. Newly introduced varieties are described. Several disease-resistant hybrids have been obtained by crossing the varieties Princesse double de Hollande and Princesse de Watou with other varieties (unspecified) showing resistance to anthracnose and virus diseases. In 1958 variety trials, Wädenswil proved to be outstanding.

Pea. The pea collection at Gembloux now consists of 362 varieties; several newly introduced varieties are described. Among F_1 to F_{10} hybrids described as being particularly interesting are H48/32–93, H50/1–64 and H54/18–3. Pedigree selection work is under way on the canning variety Gloire de Quimper [Quimper Glory] and on Merveille de Kelvedon [Kelvedon Wonder], a quick-freezing variety.

992 Brežnev, D. D.
(Utilizing heterosis in horticulture).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 7 : 29–36. [Russian].

Descriptions are given of heterotic hybrids of the following vegetable crops bred at the Majkop branch of the Institute of Plant Industry and other Soviet breeding stations: turnip, swede, onion, cabbage, melon, water melon, gourd, sweet pepper, cucumber and tomato, the last two crops including hybrids for greenhouse and outdoor culture. All these outyielded their parents and standard varieties by a considerable margin and many show improvements in earliness, keeping properties and disease resistance.

993 Wall, J. R. & York, T. L.
Gametic diversity as an aid to interspecific hybridization in *Phaseolus* and in *Cucurbita*.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 419–28.

The value of introducing genetic variability into an interspecific combination by first making intraspecific crosses was investigated in *Ph. vulgaris* x *Ph. coccineus* and *C. pepo* x *C. moschata*. Although with some intervarietal F_1 hybrids many more viable embryos were obtained in interspecific crosses than with others, no definite conclusion could be reached as to the desirability of using intervarietal F_1 hybrids rather than "pure" varieties. In general, the most favourable three-way cross of an intervarietal F_1 hybrid of one species x a "pure" variety of the other gave only slightly more favourable results than the most favourable two-way combination. A four-way cross involving an F_1 hybrid of *C. pepo* x F_1 hybrid of *C. moschata* [(Uconn x Yankee Hybrid) x (Butternut x Golden Cushaw)] yielded by far the greatest number of viable embryos among the *Cucurbita* crosses, suggesting that such multiple crosses may provide a greater opportunity for successful gene combinations.

994 **New vegetable varieties. List VI.**
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 842–48.

A further descriptive list is given of varieties of vegetables introduced since 1936 by North American federal and state institutions, trade organizations and private individuals [cf. XXIX, 788].

995 Persson, A. R. & Apeland, J.
Evolutionary and agricultural values of polyploidy with special reference to *Brassica* and *Raphanus*.
Meld. Norg. LandbrHøgsk. 1960 : **39** : Pp. 25.

This paper consists largely of a survey of (*a*) some effects of autopolyploidy, with particular reference to seed size, germination, growth rate and flowering in a number of vegetables, and (*b*) some characteristics of allopolyploidy, special mention being made of interspecific and intergeneric crosses of *Brassica* and *Raphanus*. The following observations made by the authors are also recorded. Compared with diploids, tetraploids (autopolyploids) of dill and Brussels sprouts but not of spinach had larger seeds; tetraploids of Brussels sprouts but not of dill and spinach showed a higher rate and percentage of germination; tetraploids of spinach had a lower rate of growth but continued growing for longer, so that the final fresh or dry weights were higher; tetraploids of Brussels sprouts were at first heavier than diploids but later differed little, and in addition had fewer and larger leaves, with a smaller length/width ratio, were later in sprout formation, produced fewer and less firm sprouts and showed greater mortality and a higher number of small plants; tetraploids of dill produced fewer small umbels and fewer total flowers per plant; tetraploids of tomato yielded fewer and smaller fruits; and tetraploids of Brussels sprouts, spinach and dill differed little from diploids in water content.

996 Åvall, H.
Sort- och kulturförsök med rädisor. **(Varietal and cultural tests with radishes).**
Medd. Trädgårdsförs. 1960 : No. 130 : Pp. 46.

Descriptions of varieties and strains of forcing and outdoor radishes approved as first class in the 1959 trials held at Alnarp and other stations in Sweden are included in this report.

997 Watts, L. E.
The use of a new technique in breeding for solidity in radish.
J. hort. Sci. 1960 : **35** : 221–26.

Selection for solidity may be carried out by immersing the roots in water and discarding those failing to sink. The immersion test was used to assess the quality of (1) 69 commercial varieties representing the red globe, red-and-white globe, red-and-white intermediate, long white and long red types and (2) progenies from crosses within varieties between pairs of plants selected by this method. The parents of (2) were Harrison's Cherry (red globe), Hurst's French Breakfast Forcing (red-and-white intermediate) and Fidler's Early Scarlet Frame (long red). Varieties and progenies were grown under Dutch lights and three harvests made at weekly intervals. The colour types among the commercial varieties differed widely in pithiness, percentages of pithy roots being about 60, 40 and 20 for the two red-and-white, two red and long white types respectively. At first harvest, all pair-cross progenies were considerably less pithy than their parental types. This improvement was shown throughout by the red-and-white intermediate type but not beyond the second harvest by the red globe variety or the first harvest by the long red type. Intervarietal disparities in proportion of pithy roots were significant within the red-and-white globe, red-and-white intermediate and long red types but not within the other two groups.

998 Peterson, J. L.
Studies on resistance in radish to *Fusarium oxysporum* f. *conglutinans* race 2.
Diss. Abstr. 1960 : **20** : LC Card Mic 59–5813 : 2483–84. (Abst.).

Resistance to the above pathogen proved to be polygenic. A successful start was made in developing a resistant type of White Icicle, using Early Scarlet Globe as source of resistance. Other investigations are also reported which dealt with the nature of resistance in Early Scarlet Globe and included studies of the relation of plant age, inoculum dosage and method of inoculation to resistance.

999 Forsøg med stammer af skalotteløg 1956–1958. **(Trials of strains of shallot, 1956-1958).**
Tidsskr. Planteavl 1960 : **64** : 171–74.

Data are given on 12 strains tested at three Danish stations.

1000 Raju, C. S. K.
Meiosis in an autotetraploid race of *Asparagus racemosus* Willd.
J. Indian bot. Soc. 1960 : **39** : 149–55.

A natural tetraploid race ($2n = 40$) of *A. racemosus* studied at the Department of Botany, Andhra University, showed typical autotetraploid behaviour at meiosis. It is suggested that polyembryony may be responsible for the origin of the race.

1001 Ellison, J. H., Scheer, D. F. & Wagner, J. J.
Asparagus yield as related to plant vigor, earliness and sex.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 411–15.

Data on individual plants of Raritan throughout three years revealed a positive association of full-season yield of marketable spears per plant with early yield (from first 2 weeks of cutting) and number and diameter of the stalks or "brush" in both ♂ and ♀ plants [cf. XXIX, 3181 and XXX, 3261]. Mean spear diameter was correlated positively with diameter of the early spears and with stalk diameter, and negatively with stalk number. Pictorialized scatter diagrams show these simple correlations and also bring out multiple correlations. Plants with high yield of large spears had relatively high values for early yield, brush vigour (number and diameter of stalks) and early spear diameter. If a plant ranked low in one or more of these characters, it was apt not to have a high yield of large spears. The scatter diagrams also demonstrate differences between ♂ and ♀ plants. Females varied more than males in mean diameter of the spears and in stalk and early spear diameter, whereas males varied more in total yield, early yield and stalk number. Relatively high-yielding plants may be selected on the basis of either brush vigour or earliness or, better still, both criteria.

1002 Dobschütz, B. v., Steger, H. & Rasch, D.
Futterkohl als Winterzwischenfrucht und Weidepflanze. **(Kale as an intermediate winter crop and pasture plant).**
Züchter 1960 : **30** : 168–74.

Diallel crosses were carried out with seven subspecies and forms of *Brassica oleracea* and data assembled on the weight, height, leaf production, winter hardiness and chemical composition of the F_1 hybrids. The value of the crosses was assessed numerically using a points system weighted in favour of the most important characters. The crosses *B. oleracea* subsp. *acephala* x Brussels sprouts, marrow stem kale x Savoy cabbage, marrow stem kale x *B. oleracea* subsp. *acephala* and *B. oleracea* subsp. *acephala* x *B. oleracea* subsp. *acephala* f. *laciniata* were most suitable for an intermediate winter crop; these hybrids were winter hardy and reached a height of 0·85 m. to 1·05 m. Savoy cabbage x *B. oleracea* subsp. *acephala*, marrow stem kale x Savoy cabbage, *B. oleracea* subsp. *acephala* f. *laciniata* x marrow stem kale and Brussels sprouts x *B. oleracea* subsp. *acephala* f. *laciniata* are being considered as grazing crops for March and April; for this purpose the plants have to be less than 85 cm. high and also winter hardy.

1003 Finch, C. G.
Classification and descriptions of vegetable varieties and a summary of the results of such in early summer cauliflowers.
Progr. Rep. exp. Husband. Fm. exp. Hort. Sta. 1960 : 13–17.

Some preliminary results are reported of a trial in which 101 stocks of early summer cauliflower were grown at four centres in England for two seasons. Some of the better varieties are listed, together with their order of maturity.

Earliana and Progress were of outstanding quality, both averaging at least 90% perfect heads; they matured approximately two weeks later than the earliest variety, Kvik [Lively].

1004 Wellensiek, S. J.
Annual Brussels sprouts.
Euphytica, Wageningen 1960 : **9** : 10–12.

Annual flowering, originally found in a single plant in 1953, proved to be dominant over biennial flowering and monogenically determined. Occasional deviations from the expected ratios could be explained as resulting from potentially annual plants which failed to flower through being late in flowering.

1005 van der Giessen, A. C.
Toetsing van spinazie op resistentie tegen mozaïek in het klein en in het groot. **(Testing of spinach for mosaic resistance on a small and a large scale).**
Zaadbelangen 1960 : **14** : 231–32.

Smooth-leaved mosaic-resistant spinach may be obtained by crossing resistant crinkly-leaved varieties such as Bloomsdale Blight Resistant with susceptible smooth-leaved Netherlands varieties. The preparation of an inoculum from virus-infected plants and its application in testing seedlings for resistance is described.

1006 Huyskes, J. A.
Gebruikswaardeonderzoek van het nieuwe zomersla-ras "Hilde". **(Tests of the practical value of the new summer lettuce variety Hilde).**
Meded. Inst. Vered. TuinbGewass. 1960 : No. 163 : 232–36.

A Netherlands selection of the Belgian variety Hilde, described as having the parentage Meikonigin [May Queen] x Attractie (= White Boston) [cf. XXIX, 3450], is earlier, produces heavier heads and has paler, more crinkly leaves than Attractie, which it otherwise resembles. The variety has provisionally been included in the Netherlands Vegetable Variety List.

1007 Gagnebin, F.
Analyses des caractères principaux de 16 variétés de céléris-raves. **(Analyses of the principal characters of 16 varieties of celeriac).**
Rev. hort. suisse 1960 : **33** : 150–52, 183–84, 199–204.

Gagnebin, F.
À propos de 16 variétés de céléris-raves. **(On 16 varieties of celeriac).**
Ibid. 1960 : **33** : 238–40.

The leaf, root and stem characteristics of 16 varieties of *Apium graveolens* var. *rapaceum* are described and analysed. On the basis of these characters, the varieties are classified into groups.

1008 Wolf, E. A.
Emerald—a new early blight-resistant Pascal celery.
Circ. Fla. agric. Exp. Sta. 1958 : No. S-109 : Pp. 7.

Emerald, a Pascal type developed by crossing a derivative of a hollow-stemmed Turkish introduction x Cornell 19 with Abbott & Cobb's Improved Pascal, is highly resistant to early blight (*Cercospora apii*). The first-mentioned parent was the source of this resistance. Bred for the Everglades area, Fla., Emerald is also highly resistant to the type of blackheart frequently occurring during hot weather late in the season.

Colloque d'études sur la chicorée-witloof. Organisé par la Station de Recherches de l'État pour l'amélioration des plantes fruitières et maraîchères et le Comité pour l'Étude de la Culture Maraîchère (Section II). Tenu à l'Institut agronomique de l'État, à Gembloux, le 27 novembre 1959. [**Colloquium of studies on witloof chicory. Organized by the State Research Station for the improvement of Fruit and Market-garden Crops and the Committee for the Study of Market Gardening (Section II). Held at the State Agronomic Institute, Gembloux, 27 November, 1959**].
Ann. Grembl. 1960 : **66** : 89–192.

1009 *Gagne, J. B. L'étude des variétés.* (*The study of varieties*). (*pp. 100–10*).

An outline is given of some of the difficulties involved in developing well defined varieties, particularly with regard to earliness, in *Cichorium intybus.*

1010 *Huyskes, J. A. Le forçage en relation avec le cycle de végétation.* (*Forcing in relation to the vegetative cycle*). (*pp. 121–38*).

The results of experiments on vernalization and forcing in very early, early and semiearly types, represented by La plus hâtive de Kampenhout [Kampenhout Earliest], Hâtive de Malines [Malines Early] and Oranje [Orange] respectively, are discussed. It is considered that selection for earliness should be made in two stages, firstly for the early development of large roots in the open and secondly for resistance to high forcing temperatures.

1011 *Plumier, W. Biologie florale et fécondation.* (*Floral biology and fertilization*). (*pp. 151–56*).

Eighteen families developed from root pieces of 18 mother plants of a single population were grown, and individual plants were isolated to eliminate cross pollination. Of 140 plants examined only one failed to set seed. Despite variations between families the seeds collected from individual plants developed in every case into plants identical to the parents and no segregation occurred. It is concluded that self fertilization did not take place and that reproduction was by apogamy.

1012 JEREBZOFF-QUINTIN, S.
Transmission héréditaire des fasciations de *Cichorium intybus* et de ses particularités structurales. (**The inheritance of fasciations in *C. intybus* and their structural peculiarities**).
Bull. Mus. Hist. nat. Toulouse 1958 : **93** : 51–56.

A fasciated plant found in the Botanical Garden of Toulouse produced progeny in which 12·5% of the plants resembled the mother plant in appearance and in anatomical structure, having a complete ring of secondary thickening and pericyclic fibre bundles, both of which features are absent in normal plants.

1013 AKAI, S. & YASUMORI, H.
(**The pathogenicity of *Colletotrichum lagenarium* to cucurbits**).
Nihon Shokubutsubyori Gakkai Ho/Ann. phytopath. Soc. Japan 1958 : **23** : 156–57. [Japanese].

In tests of 20 varieties of various Cucurbitaceous species, *Trichosanthes* sp. and a bitter-gourd variety were immune.

1014 JAMES, E., MASSEY, J. H. & CORLEY, W. L.
Effect of a plant arrangement on cross-pollination of muskmelons.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 480–84.

To determine the amount of outcrossing in single, isolated rows, yellow-green, single-recessive mutants were interspersed with dominant normal green plants. Four recessive plants followed by one dominant constituted a single replication. Yellow-green and normal green plants may both be recognized at the cotyledon stage. In no case was there evidence of outcrossing in plants spaced 32 ft. from the dominant marker, with three intervening recessives. Overall outcrossing averaged 0·62% in 1957 and 0·92% in 1958. The greatest amount of outcrossing, 5·79%, occurred in 1957 on the recessive next to the marker. On the basis of the results, suggestions are made as to planting techniques for producing selfed or sibbed seed without hand pollination for breeding purposes.

1015 BROWN, R. T., ADAMS, A. J. & MILLER, J. C.
Delta Gold. A new variety of cantaloupe.
Circ. La. agric. Exp. Sta. 1960 : No. 62 : unpaginated.

Developed from (Georgia 47 x Weslaco H) x a native musk melon, Delta Gold has given outstandingly good results in southern Louisiana.

Resistant to downy and powdery mildew and other leaf spots, it is similar in appearance to Imperial 45, being round to oval and well-netted, with deep salmon flesh and small seed cavity. It ripens early and over an extended period.

1016 Dutta, S. K., Hall, C. V. & Heyne, E. G.
Observations on the physiological races of *Colletotrichum lagenarium*.
Bot. Gaz. 1960 : **121** : 163–66.

Five isolates of *C. lagenarium* (*Glomerella lagenaria*) were studied, using Black Diamond, Charleston Gray and Chris Cross water melon varieties and Model and PI163213 cucumbers as differential hosts. Four physiological races were identified, race 4 being described for the first time.

Charleston Gray, Congo, Fairfax and Black Diamond water melons were inoculated with the four races. Only Black Diamond was susceptible to all races, the others being resistant to races 1, 3 and 4 and susceptible to race 2. The varieties were intercrossed and their hybrids tested for disease reactions. All the hybrids were resistant to races 1, 3 and 4 and susceptible to race 2. Studies of F_2 and back crosses for reaction to race 3 indicate that resistance to this race is controlled by a single dominant gene. No segregation was observed in progenies of crosses involving Charleston Gray, Congo and Fairfax in reaction to race 2, indicating that these varieties are homozygous for susceptibility to this race.

1017 Dutta, S. K., Hall, C. V. & Heyne, E. G.
Pathogenicity of biochemical mutants of *Colletotrichum lagenarium*.
Bot. Gaz. 1960 : **121** : 166–70.

The growth responses of the four physiological races of *C. lagenarium* (*Glomerella lagenaria*) and of 17 biochemical mutants of race 2 on epidermal and whole-tissue extracts of resistant and susceptible varieties of water melon, musk melon, squash and cucumber are reported. It is suggested that resistance, at least in the Butternut squash, may be due to an epidermal inhibitory mechanism.

1018 Hall, C. V., Dutta, S. K., Kalia, H. R. & Rogerson, C. T.
Inheritance of resistance to the fungus *Colletotrichum lagenarium* (Pass.) Ell. and Halst. in water-melons.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 638–43.

An isolate of *C. lagenarium* (*Glomerella lagenaria*) from Georgia, USA, was more virulent to seedlings of all five varieties tested and produced the ultimate degree of infection earlier than the Madison II strain from Wisconsin. Congo was slightly more resistant to the Georgian isolate than Charleston Gray and Fairfax; Black Diamond and Chris Cross were susceptible to both. An isolate from Kansas incited the same varietal reactions as Madison II. So far as the Kansas strain was concerned, resistance was controlled by a single dominant gene.

1019 Polubesova, E. I.
(Growing melons and water melons in northeastern White Russia).
Trud. Belorussk. sel'skohozjajstv. Akad. (Trans. White Russ. agric. Acad.) 1959 : **32** : 125–31. [Russian].

Gruntovaja Gribovskaja [Outdoor Gribovo] and Kommunarka were distinguished by earliness and yield among the melons tested in the Gorki district in 1951 and 1952. The melons Podmoskovnaja Lebedevoj 7/8 [Lebedeva's 7/8 Moscow] and Kolhoznica [Collective Farmer] ripened later but were productive of high-quality fruit, while Dagestan and local Šul'gino had large fruit and combined earliness with high yield and tolerance of waterlogged soil. The water melons Stokes and Skorospelka Har'kovskaja [Early Har'kov] were earlier than all other varieties but less productive than Krasavčik 55 [Handsome 55] and Muraška 123 [Ant 123], which did not ripen sufficiently for seed production. The fruit of all four varieties was of high quality.

1020 Green, C. H.
Effects of ploidy differences on horticultural characteristics and disease resistance in watermelons.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–4144 : p. 1519. (Abst.).

Plant and fruit characters and *Fusarium*-wilt resistance were studied in diploids, triploids and tetraploids of Klondike R–7, Purdue Hawkesbury, Early Bird and Early Canada. The tetraploids had larger pollen grains, leaves and staminate flowers than their diploid parents, triploids being intermediate. Diploid varieties having ellipsoidal fruits gave rise to round-fruited tetraploids. Crosses between such tetraploids and diploids with ellipsoidal fruits resulted in progeny intermediate in fruit shape. Progenies from crosses between round-fruited tetraploids and diploids had round fruit. Tetraploids derived from $2x$ parents with ellipsoidal fruit had lower fruit weight than diploids. Diploids, triploids and tetraploids of the same variety did not differ in soluble-solids content. Some triploids and tetraploids had an undesirable taste which was never detected in the fruits of diploids and was more pronounced in the tetraploids and in immature and overripe fruits. In crosses between plants bearing fruits with dark and light green rind, the progeny always had dark green rind, regardless of whether the dark-green parent was 2*x* or 4*x*. Some 4*x* x 2*x* combinations produced triploids with hollow heart, irregular fruits, thick rind and large seed coats. In an attempt to breed seedless 3*x* water melons, it was not possible to predict the desirability of the triploid by parental performance. None of the triploids showed commercial promise. Better triploids were however produced by crossing two diverse parents rather than closely related ones; e.g. the triploid of Early Canada (4*x*) x Klondike R–7 (2*x*) bore more satisfactory fruits than that of Klondike R–7 (4*x*) x Klondike R–7 (2*x*). Tetraploids and 3*x* Purdue Hawkesbury produced only culls. *Fusarium*-wilt resistance did not increase as the result of polyploidy, as shown by comparing resistant Klondike R–7 with its 3*x* and 4*x* forms.

1021 BAINTNER, K. & ILLÉS, A. (Mrs.)
Különböző takarmánytökfajták táplálóértékének és ásványi anyagainak vizsgálati adatai. (**Trial data on the fodder value and mineral substances of various fodder pumpkins**).
Agrártud. Egy. mezőgazdaságtud. Kar. Közl., Gödöllő 1959 : 255–62.

From data on the contents of dry matter, protein, fat, fibre, starch, N-free extract, ash, sugar, carotene, calcium, magnesium and phosphorus of 15 varieties of *Cucurbita maxima* tested at Gödöllő, Hungary, Golden Delicious, Walfisch [Whale], Nagydobosi [Drum Major] and Sárga óriás [Yellow Giant] are recommended for fodder.

1022 TAKAHASHI, M. & OISHI, C.
(Studies on the mechanism of resistance to damping off of seedlings. II. Alteration of the susceptibility of the host by either treatment or abnormal environmental conditions).
Nihon Shokubutsubyori Gakkai Ho/Ann. phytopath. Soc. Japan 1958 : **23** : 131–34. [Japanese].

After ether narcosis *Cucurbita pepo* 'Amakuri' [Sweet Chestnut], a variety normally resistant to damping off caused by *Pythium ultimum*, was as readily infected as normally susceptible varieties.

1023 MARTIN, M. W.
Inheritance and nature of cucumber mosaic virus resistance in squash.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–617 : p. 3462. (Abst.).

A positive correlation was found between nitrate content of *Cucurbita pepo* plants and susceptibility to cucumber mosaic virus (CMV) infection. Two resistant lines, 176959 and 174192, were crossed with each other and with five susceptible lines; inheritance studies suggest that CMV resistance in each resistant parent is controlled by two recessive genes. "There is evidence that these two parents share a recessive gene for resistance which by itself can confer 'field' resistance but that this 'shared' gene must be accompanied by a second complementary gene from either of the parents before resistance under more severe conditions is produced. Both genes together, however, will not completely prevent infection under extremely severe conditions."

CMV resistance in *C. maxima* and in *C. moschata* 'Butternut' appeared to be controlled by a recessive gene or genes but in the highly resistant *C. moschata* 'Batangas Native' resistance is apparently controlled by a dominant gene or genes.

1024 PETERSON, C. E. & ANHDER, L. D.
Induction of staminate flowers on gynecious cucumbers with gibberellin A_3.
Science 1960 : **131** : 1673–74.

Induction of staminate flowers on gynecious plants has made it possible to establish and increase inbred lines bearing only pistillate flowers. This method of altering sex expression should facilitate the production of F_1 hybrid seed and also investigations on the genetics and physiology of sex.

1025 KARGL, T. E., QUACKENBUSH, F. W. & TOMES, M. L.
The carotene-polyene system in a strain of tomatoes high in delta-carotene and its comparison with eight other tomato strains.
Proc. Amer Soc. hort. Sci. 1960 : **75** : 574–78.

Six of the nine genotypes analysed fell into two groups: (1) those having predominantly alicyclic C_{40} polyenes ($BB\ mo_B^+mo_B^+$, $BB\ mo_Bmo_B$ and the strain with high δ-carotene content) and (2) those having predominantly acyclic carotenes and polyenes ($B^+B^+\ mo_Bmo_B$, $B^+B^+\ mo_B^+mo_B^+$ and *tt*). No gene symbol has been assigned to the strain with high content of

δ-carotene. Within the two groups, differences in degree of conjugated unsaturation and ionone-ring formation occur. The remaining three genotypes (*atat*, *rr* and *rr tt*) were not classified, because the greatly reduced total pigment content of the fruits did not permit a reliable appraisal.

1026 WEBER, E.
The genetical analysis of characters with continuous variability on a Mendelian basis. II. Monohybrid segregation and linkage analysis.
Genetics 1960 : **45** : 459–66.

"The method described in Weber (1959) for genetical analysis of characters with continuous variability on a Mendelian basis by means of a discriminant function, is applied to an F_2 generation with regard to the inheritance of the characters cotyledon size and primary leaf size in two varieties of tomato. Linkage analysis of characters with continuous variability is illustrated by a model." [Cf. XXX, 3291].
[Author's summary].

1027 WEBER, E.
The genetical analysis of characters with continuous variability on a Mendelian basis. III. Dihybrid segregation.
Genetics 1960 : **45** : 567–72.

The method described by the author [cf. XXX, 3291] for genetical analysis of characters with continuous variability on a Mendelian basis by means of discriminant functions was applied to the F_2 of a cross between two tomato lines and back crosses of the F_1 to both parents. The character analysed, cotyledon size, was found to be controlled by two factors.

1028 WALLACE, M. E.
A possible case of affinity in tomatoes.
Heredity 1960 : **14** : 275–83.

Sawant's data on *a*, *c*, *sp* and ms_2 from *Lycopersicon esculentum* x *L. hirsutum* [cf. XXIX, 2039] are analysed in order to detect quasi-linkage [cf. 670]. Genes *a* (linkage group V) and *c* (IV) are found to recombine with values significantly below 50%, while *sp* (IV) and ms_2 (I) are found to recombine with a value significantly exceeding 50% in hybrids from one cross and with a value nonsignificantly above 50% in hybrids from another. The data are shown to fit the hypothesis of affinity well. Assuming affinity and only two types of centromere, the genetic constitution of the chromosomes corresponding to linkage groups I, IV, and V in Sawant's material may be given respectively as follows, α denoting centromeres of *L. hirsutum* ancestry and β centromeres of *L. esculentum* ancestry: $ms_2\,\alpha$, $c\ sp\ \beta$, $a\ \beta$ (chromosomes derived from *L. esculentum* 'San Marzano' and 'Pearson'); $+\ \beta$, $+\ +\ \alpha$, $+\ \alpha$ (chromosomes derived from Baños stock of *L. hirsutum*) and $+\ \alpha$, $+\ +\ \alpha$, $+\ \alpha$ (chromosomes derived from the Chillon stock of *L. hirsutum*). The presence of a centromere of *L. esculentum* ancestry in the Baños stock and one of *L. hirsutum* ancestry in *L. esculentum* may be most readily explained by supposing that an interchange of genetical material has taken place through hybridization after interspecific differentiation of the centromeres had occurred. Interchange may be expected to result in greater morphological similarity between these two stocks than between the Chillon stock and *L. esculentum*. This expected result agrees with the conclusion reached by Sawant from morphological, physiological and cytogenetical considerations that Baños is more closely related to *L. esculentum* than Chillon. The relations between groups V and X are briefly discussed and affinity is found to reconcile the paradox that some data show linkage between them and others independence. The procedure of experiments to test the affinity hypothesis in the tomato is discussed.

1029 LAMBETH, V. N.
Origin and performance of Tuckcross forcing tomatoes.
Proc. Amer Soc. hort. Sci. 1960 : **75** : 570–73.

F_1 hybrids involving Tuckers Forcing showed a significant amount of heterosis, as shown by increases in both early and total yields of marketable fruit over the parent varieties under favourable conditions. Since differences in productivity among the hybrids were not significant, choice of hybrid should be made on the basis of fruit size, maturity and other fruit characteristics according to the requirements of the market. The near immunity of Tuckers Forcing to *Fusarium oxysporum* f. *lycopersici* and the resistance of this variety to race 1 of *Cladosporium fulvum* were transmitted to the F_1s to a highly satisfactory degree. The reaction of Tuckers Forcing to the first disease was inherited from *Lycopersicon pimpinellifolium*. Bay State Forcing, also involving *L. pimpinellifolium* in its pedigree, contributed to the resistance of Tuckers Forcing to the second pathogen.

1030 Bishwajit Choudry

Hybridisation between *Lycopersicon esculentum* Mill and *Lycopersicon peruvianum* Mill.

Indian J. Hort. 1959 : **16** : 102–07.

Hybrids were obtained only from *L. esculentum* ♀ x *L. peruvianum* ♂ with the aid of embryo culture [cf. XXVII, 940], and from *L. esculentum* (4*n*) ♀ x *L. peruvianum* (2*n*) ♂. Grafting or use of *L. peruvianum* var. *dentatum*, *L. peruvianum* x var. *dentatum* or a mixture of *L. esculentum* and *L. peruvianum* pollen, in pollinating *L. esculentum*, did not give successful results. Spraying with p-chlorophenoxyacetic acid after fertilization increased the number of occasional large seeds, suitable for embryo culture, derived from *L. esculentum* ♀ x *L. peruvianum* ♂.

1031 Michie, D. & Nirk, H.

Interspecific hybrids of *Lycopersicum.*

Nature, Lond. 1960 : **186** : p. 1071.

Referring to Nirk's use of reciprocal grafting in crossing *Lycopersicon* spp. [cf. XXX, 2045], Michie draws attention to the large-scale application of the similar method, "vegetative approximation," by Mičurin. Nirk replies that, irrespective of whether the results of the work in question furnish corroborative evidence of Mičurin's claims, their immediate significance lies in their application in practical breeding, particularly in hybridization of *Lycopersicon* spp.

1032 Williams, W.

The effect of selection on the manifold expression of the "suppressed lateral" gene in the tomato.

Heredity 1960 : **14** : 285–96.

Discovered in Antimold B during 1951, mutation *ls* (suppressed lateral) has the following phenotypic effects when homozygously recessive: (1) suppression of axillary branches; (2) suppression of apical growth at various stages of growth in certain genotypes; (3) a suppression of corolla development resembling that caused by *ap* (apetalous); (4) deformed anthers which fail to remain united as a column around the style, failure in pollination and sterility thus resulting; (5) reduction in flower number per inflorescence; and (6) in certain genotypes the formation of partially apocarpous, parthenocarpic fruits phenotypically similar to those due to *gq* (grotesque). All the expressions of *ls* show quantitative variation and with the possible exception of (4) may be explained by assuming that the locus concerned controls development of the primary meristem. Thus the effects of *ls* are possibly the result of "spurious" pleiotropism, in that they may be the consequence of a single error in gene function which expresses itself at various stages in development. An analysis was made of variation mainly in (1), (2) and (5) in relation to the different genetic backgrounds of crosses within *Lycopersicon esculentum*, and also of interspecific crosses with *L. pimpinellifolium*. The effect of modifiers on one expression was not accompanied by a correlated response in other expressions of *ls*. Thus discrimination between the components of a complex series of reactions resulting from one major gene mutation may occur as the result of the action of the gene milieu, modifications of only one of the manifold effects being brought about at a time. The most pronounced modifier influence was evident in F_2 progenies from interspecific crosses, the release of variability from crosses within *L. esculentum* being in most cases negligible. No cross-over phenotype for component expressions of the *ls* syndrome was detected in segregating progenies amounting to 57,268 plants. The effects of interactions between *ls* and other marker genes with respect to flower number were determined. It is suggested that the results were compatible only with an interpretation based on some type of pleiotropic action of *ls* which is influenced by certain genetic backgrounds. The unidirectional nature of quantitative characters when associated with major gene mutations is discussed and is regarded as evidence supporting the hypothesis that indirect, direct or spurious pleiotropic actions of major genes may account for much of the quantitative variation hitherto ascribed to linkage. It is further suggested that, when resolution of highly associated characters is being attempted, wide crossing may be expected in many instances to provide a better opportunity for selection than procedures designed to break linkages. [Cf. XXIX, 1135].

1033 Yu, S.-A.

The effects of radiation on Chatham tomato seeds.

Diss Abstr. 1960 : **20** : LC Card Mic 59–3436 : p. 3013. (Abst.).

Percentage germination was normal in thermal-neutron or X-irradiated seeds, but viability decreased with dose, 50,000 r. X rays being lethal and 1·0 x 10^{14} thermal neutrons almost lethal. Similar types of abnormalities were induced by both treatments and included morphological anomalies, chlorophyll changes and partial or complete sterility. Mutations detected include: green stem (a_2); grey necrotic (*ne*-I); wiry leaves (*w*); slender stem (*sm*); tripinnate leaves (*tp*); curly leaves (cu_2); drooping leaves (*dp*); suppressed roots (*Sr*); and round leaflets and absence of chlorophyll, both recessive. Somatic or nonheritable mutations were also induced. Among apparent mutations that were not tested were early ripening and resistance to early blight.

1034 GARDÉ, A.
The effect of ionizing radiations on quantitative variation in plants. II. Genetical effects of radio-active phosphorus in *Lycopersicon*.
Genet. iber. 1960 : **12** : 1–19.

In a study of the effects of P^{32} on the highly selected tomato variety Potentate, it was found that variability in time of flowering was significantly increased as compared with untreated controls. It proved possible to select superior early and late lines from the irradiated progeny, and a study of these selections confirmed that the effects were genetic. Thus, although Potentate is a variety selected for earliness, it apparently still contains a number of recessive alleles for earliness capable of being altered by P^{32}.

In the case of the unselected, early-flowering species *L. pimpinellifolium*, there was an increase only in the number of late-flowering plants and only late lines could be selected. This species is thought to have a large number of dominant alleles for earliness. In an examination of different levels of P^{32} irradiation, it was found that variability fell with increase in dose, while the mean flowering date was earlier in the progeny of plants receiving high doses. Qualitative changes such as abnormal leaf and fruit development also occurred; these are listed and discussed.

The author points out that radioactive isotopes could be of considerable importance in selection for those quantitative characters which have already been highly selected by conventional breeding techniques.

1035 EMERY, G.
Biological effects of a chemical mutagen, diepoxybutane, on tomato.
Science 1960 : **131** : 1732–33.

Seeds presoaked in distilled water were treated with 0·2, 0·5 and 0·8% solutions of 1:2,3:4-diepoxybutane for 1 hr. under vacuum conditions followed by 5 hr. at normal pressure. Seedling mutations were induced with a high frequency by all doses. Most mutants were chlorophyll-deficient types. Apparent pleiotropic effects on growth rate and morphology were characteristic of many of the chlorophyll mutants. Lethality in the seedling stage or sterility prevented recovery of the mutations in a homozygous condition. In the treated generation, delayed germination, sectoring for chlorophyll-deficiency in the first true leaves and failure to bear fruit occurred only with the highest concentration.

1036 **Dwarf tomato released.**
Crops & Soils 1960 : **12** : No. **7** : p. 20.

Epoch is a new dwarf tomato variety developed by Purdue University and suitable for commercial planting. It is wilt resistant and high yielding, producing normal-sized tomatoes of good texture and taste.

1037 **Marion tomato released.**
Crops & Soils 1960 : **12** : No. **9** : p. 25.

This variety, described as superior to present varieties, has been released by the Clemson College Agricultural Experiment Station, South Carolina. The fruit is large, smooth and uniform and resembles Rutgers in general appearance. Marion is resistant to *Fusarium* wilt, gray leaf spot and cracking; it is moderately resistant to early blight.

1038 JENKINS, J. M. (JUN.).
Which tomato variety ?
Res. & Fmg. 1959 : **18** : p. 14.

Among the varieties mentioned as suitable for North Carolina are two high-yielding hybrids, Big Boy and Moreton Hybrid. The latter produces slightly smaller fruits than Big Boy which is also the higher yielder. Other high-yielding varieties are Stokesdale, Jefferson and Valiant; the last-named is the earliest.

1039 MILLER, J. C., HERNANDEZ, T. P. & TIMS, E. C.
Red Global tomato.
Seed World 1959 : **85** : No. **8** : p. 12.

This new variety, formerly known as L–3, was selected from the cross Louisiana Slicer x Marglobe. It is very high-yielding, particularly under autumn conditions when many other varieties fail to produce a satisfactory crop. It has shown a high degree of resistance to *Fusarium* wilt and foliage diseases. The fruit is bright red in colour, shows some degree of resistance to cracking and has a mild, sweet flavour. The locules are small and contain comparatively few seeds. Red Global is recommended as a second early variety and for the autumn crop.

1040 HAYSLIP, N. C., WALTER, J. M. & KELBERT, D. G. A.
Indian River. A new disease-resistant tomato of general adaptability.
Circ. Univ. Fla. agric. Exp. Sta. 1958 : No. S–111 : Pp. 11.

A detailed description is provided of the above variety, which possesses multiple disease resistance [cf. XXIX, 3163].

1041 GRANT, W. F. & HARNEY, P. M.
Cytogenetic effects of maleic hydrazide treatment of tomato seed.
Canad. J. Genet. Cyt. 1960 : **2** : 162–74.

Seeds of the highly inbred English variety Carter's Sunrise were treated with aqueous solutions of maleic hydrazide (MH) for 6–48 hr. The progeny of plants raised from the treated seed is referred to as the C_1. Bridges and fragments were observed at anaphase in C_1 and C_2 root tips, as well as a few c-mitotic nuclei and multipolar cells. Anaphase bridges were also seen in tapetal cells of the anthers and in meiosis I. The percentage of irregular anaphases in root tips ranged from 0 to 33% among C_2 mature plants having mutant or abnormal phenotypes. No supernumerary microspores were observed in the quartet stage in cytologically irregular C_2 plants and the pollen appeared to be characteristically uniform in size. Since the majority of the anaphase abnormalities scored in C_2 root tips were bridges and bridges were also found in C_3 root tips, it appears that anaphase bridges were carried over from one generation to the next through initiation of a breakage-fusion-bridge cycle. A number of phenotypes closely resembling known mutants appeared in the C_2, suggesting that MH is a mutagenic agent. The effect of MH in increasing the frequency of "rogue", a cytoplasmically inherited mutant occurring in the C_2, was significant.

1042 KALIA, H. R.
A cytogenetic study of asynapsis in tomato (*Lycopersicon esculentum* Mill.).
Diss Abstr. 1960 : **20** : LC Card Mic 60–757 : p. 3479. (Abst.).

Failure to set fruit in the variety Marglobe was associated with asynapsis. The variety was fertilized using pollen from an inbred woolly strain also carrying the recessive marker genes *bk*, *c*, *j*, *t*, *u* and *y*, and also with pollen from Walter–15 which is immune to one strain of tobacco mosaic virus. The frequency of asynaptic plants in the F_2 was low and the intensity of asynapsis was variable, affecting one to six pairs of chromosomes. The F_2 data indicated that two recessive genes were involved, but the F_3 progeny from a selfed asynaptic F_2 plant contained only a few asynaptic plants, again showing variable intensity of asynapsis. Genetic interference in the segregation of *j* in the F_2 by means of reciprocal back crosses was thought to be due to the microsporic lethal gene *x* linked with *j* in linkage group V. The map distance between *x* and *j* was found to be 7·2 units. In the F_1 progenies of both crosses aneuploids, usually trisomics, of diverse morphology and fertility appeared, indicating that asynapsis was also operative in megasporocytes and that asynapsis was affecting all chromosome pairs; two trisomics were tentatively identified as triplo–1 and triplo–10. For the situation in which a microsporic lethal gene is linked with another gene, a hypothetical frequency table was computed for genotypes among progenies resulting from selfing of the eight possible types of trisomic when both loci are on the trisome. One aneuploid with 8–10 extra chromosomes was weak, had light-green foliage and set no fruit; the survival of the megaspore and zygote resulting from it is attributed to their near-diploid and near-triploid condition respectively.

An invariant association is reported for anther colour and fruit flesh colour. Tangerine fruits were invariably produced by plants with orange-anthered flowers, and red fruits by plants with yellow-anthered flowers.

1043 SCHILOWA, I. & MERFERT, W.
Ein Beitrag zum Problem der vegetativen Hybridisation von Tomaten. **(A contribution to the problem of vegetative hybridization of tomatoes).**
Züchter 1960 : **30** : 73–77.

Graft hybridization experiments were carried out using three varieties which differ in time of ripening and in fruit and leaf characters. In the F_0 generations no marked changes were observed in the characters of the scions and their fruit. The rootstock appeared to have some effect on the maturity period of F_1 progenies of the combinations Goldene Königin [Golden Queen]/Frühe Liebe [Early Love] and Lukullus/Goldene Königin, for the progenies ripened earlier than the corresponding scion varieties on their own roots. The combination Goldene Königin/Frühe Liebe showed heterosis in the F_1, the yield being 110% of that of Goldene Königin; the occurrence of red fruit in the F_2 of the same combination may also have been due to the influence of the rootstock.

Leaf form was not affected by the rootstock in F_1 and F_2 progenies.

1044 Gladstones, J. S. & Hunter, A. W. S.
Effects of seed moisture content and post-irradiation storage on the growth and survival of X_1 tomato plants.
Canad. J. Genet. Cyt. 1959 : **1** : 339–46.

Sensitivity of seeds of *Lycopersicon esculentum* var. *cerasiforme* to X rays, as measured by inhibition of seedling growth, increased tenfold as the water content of the seeds decreased from 12·2% to 1·2% (wet weight basis). Raising the water content to 33·3% also led to a considerable increase in sensitivity. It was found that there was a linear relationship between the relative humidity during storage and the radiation dose tolerated. Compared with the controls, no detectable change was observed in either growth or survival as a result of post-irradiation storage at any moisture content.

1045 Kużdowicz, A.
Das Problem der Fertilität und der Ertragsfähigkeit von Autotetraploiden der Gattung *Lycopersicon* Mill. (**The problem of fertility and yielding ability of autotetraploids of the genus *Lycopersicon* Mill.**).
Züchter 1960 : **30** : 6–11.

Tetraploids of Immun, Earliest of All, Potentate, Potentate x Mory 33, *L. pimpinellifolium* var. *pimpinellifolium* and provar. *ribesoides* and *L. esculentum* var. *cerasiforme* produced by colchicine treatment were studied. In all cases the vegetative and generative organs of the tetraploids were larger than those of the diploids. Tetraploids of all the cultivars had a much longer vegetative period than the corresponding diploids; in the tetraploids of the wild species the delay in attaining maturity was not so great. Whereas tetraploids of the cultivars had a poor fruit set and showed a decrease in the size and weight of the fruit, tetraploids of *L. pimpinellifolium* showed a good fruit set and an increase in fruit size and weight; fruit of 4*x* *L. esculentum* var. *cerasiforme* was no larger than that of the corresponding diploid. Attempts to improve fruit weight by selection and crossing of the best individuals had little success; better results were obtained when selection began in the C_1 generation than in later generations.

All the tetraploids showed a reduction in fertility, this being most marked in the cultivated types. Fertility was not improved by the selection and crossing of individuals with regular meiosis. It seems that meiotic abnormalities are not the only cause of low fertility. Crosses were made between tetraploids of the cultivars and tetraploids of *L. pimpinellifolium* provar. *ribesoides* and *L. esculentum* var. *cerasiforme*. Hybrids showed good fruit set and fertility; fruit size was improved by back crossing to the cultivar.

1046 Firbas, H.
Betrachtungen zum Problem der Frostresistenzzüchtung von Tomaten. (**Comments on the problem of breeding for frost resistance in tomatoes**).
Züchter 1960 : **30** : 1–2.

Selection for frost resistance in the field was carried out for two years with a cross between the Argentine variety Platense and North American Pearl Harbour; in tests in a cold chamber, the selections suffered as much as known susceptible varieties. It is concluded that frost resistance may only be improved by crossing with resistant wild species. *Lycopersicon peruvianum* and *L. hirsutum* are resistant to frost.

1047 Young, P. A.
Crease stem with bunchy top of tomatoes.
Phytopathology 1960 : **50** : 577–78. (Abst.).

Observations on summer tomatoes have revealed considerable varietal differences in susceptibility to crease stem, a physiological abnormality associated with excellent growing conditions, especially abundant nitrogen and water. The percentage of plants affected in populations of different varieties and selections was as follows; Stokesdale 0%, Firesteel 2%, Hotset 4%, Rutgers 17%, STEP329 40%, Greater Baltimore 43% and SI948 68%.

1048 Murakishi, H. H.
Comparative incidence of graywall and internal browning of tomato and sources of resistance.
Phytopathology 1960 : **50** : 408–12.

The incidence of gray wall and internal browning diseases in tomato plants infected with or free of tobacco mosaic virus and under high or low light intensities [cf. XXX, 1338] was investigated using Fireball, Homestead, Indian River, Manalucie, PI235673, W-1 and W-2. The last three varieties are considered to be likely sources of resistance to both browning diseases.

1049 Wilson, J. B. & Gallegly, M. E.
Nutrition and environment in relation to development of late blight on resistant and susceptible varieties of tomatoes.
Phytopathology 1960 : **50** : p. 574. (Abst.).

A study involving one susceptible variety, two multigenic resistant and two dominant-gene resistant accessions, indicated that the concentration of the nutrient solution, light intensity and air temperature all influence resistance to *Phytophthora infestans*. The resistance of all varieties increased between the 7th and 39th day after transplanting.

1050 Knight, D. E.
Studies on *Didymella lycopersici* Kleb., the causal fungus of stem rot disease of tomatoes.
Trans. Brit. mycol. Soc. 1960 : **43** : 519–22.

Studies on single ascospore cultures of *D. lycopersici* suggest that the fungus is heterothallic.

1051 Castronovo, A., Azzolini, J. H., de Sedeño, A. R. O. & Goldenberg, J. B.
Comportamiento de variedades y procedencias de berenjena durante la campaña agrícola 1957–1958. **(Performance of varieties and strains of egg plant during the agricultural season 1957-1958).**
Bol. Inform. Inst. Fitotec., Castelar 1959 : No. 9 : Pp. 5.

In tests of 11 introduced and Argentine varieties and strains at Castelar, Argentina, the Argentine variety Violeta Media Larga [Medium Long Purple] was best.

1052 Matuo [Matsuo], T. & Ishigami, K.
(On an egg-plant wilt caused by *Fusarium oxysporum* f. *melongenae* n.f.).
Nihon Shokubutsubyori Gakkai Ho/Ann. phytopath. Soc. Japan 1958 : **23** : 189–92. [Japanese].

The above pathogenic form infects egg plants but not other Solanaceous crops. In a comparative test of 9 egg-plant varieties, the variety least affected was Tsudanaga [Tsuda Long].

1053 Miller, J. C., Jones, L. G. & Wilson, W. F. (Jun.).
Gold Coast okra.
Seed World 1959 : **85** : No. 8 : p. 13.

Gold Coast is a cross between the Louisiana Market varieties and a plant introduction, PI3650, from the Gold Coast. It has a straight, dark-green pod and is excellent both for freezing and for the local market. It is resistant to heat and fruits over a long period of time. The plant is dwarf and hence the fruit is easy to harvest.

1054 Rabechault, H.
Recueil iconographique des espèces comestibles de légumineuses africaines. **(An illustrated description of the edible African legumes).**
Riz et Rizic. 1960 : **6** : 38–44.

The main morphological characteristics of 6 edible African legumes are presented. In all 55 species are enumerated, and further descriptions will appear in due course.

1055 Panos, D. A.
A contribution to explaining the potential variability of *Vicia faba* L.
Euphytica, Wageningen 1960 : **9** : 57–73.

In trials held in Greece, local varieties tended to do better than the Larissa selection Ky–128 in areas to which they were adapted. Data are given on seed and pod yield in bagged and unbagged plants of variety M–3422 grown in three successive years from seed selected from the best unbagged plant. The unbagged plants showed a wider variation in seed production than the bagged but always gave higher total yields. Although the selected seeds were medium in size each year, mean seed size decreased in successive years. Further yield data are given for 16 other varieties.

1056 Gottschalk, W.
Untersuchungen über die Befruchtungsverhältnisse von *Vicia faba* mit Hilfe einer früh erkennbaren Mutante. **(Investigations on the fertilization ratios of *V. faba* with the help of a mutant recognizable early in development).**
Züchter 1960 : **30** : 22–27.

A mutant form of *V. faba* f. *minor* in which the earliest leaves are simple can be distinguished from normal forms as a young seedling [cf. XXIX, 2098]. Mutant and normal plants were grown in alternate rows 20 cm. apart and seed was collected from the mutant plants; the progeny showed that cross fertilization had occurred in 40% of the 5000 cases examined during three years with favourable weather. When the rows were 1 m. apart, cross fertilization was reduced to 25%; it was only 4·9% when the two genotypes were separated by 8 m. No evidence of selective fertilization was found when a mixture of pollen of both genotypes was placed on the stigma of the mutant.

1057 Arruda, H. V. de
Sôbre a necessidade de fileiras de bordadura, em experiências de campo. **(On the necessity of guard rows in field experiments).**
Bragantia 1959 : **18** : 101–06.

Guard rows were found not to be necessary in a trial involving 11 bean varieties at the Ribeirão Prêto experimental station, Brazil.

1058 Feenstra, W. J.
Biochemical aspects of seedcoat colour inheritance in *Phaseolus vulgaris* L.
Meded. LandbHoogesch., Wageningen 1960 : **60** : No. **2** : Pp. 53.

The biochemical effects of the genes *Sh sh*, C C^r c^u and V v^{lae} upon testa colour were studied in the 12 possible homozygotes, each with the same background of other colour genes, viz. *P d b g Rk*. In the presence of *V*, which turns the testa colour conditioned by *C* or C^r into a bluish colour, the leucoanthocyanidins (LA), flavonol glycosides (FG) and anthocyanins (AC) formed under the control of genes at other loci mostly have three –OH groups in the B ring; in the presence of v^{lae}, such compounds have only one or two –OH groups. The interactions observed between loci suggest that *V* acts on a precursor of all these compounds. It appeared that the number of –OH groups in the B ring influences the action of other genes determining the heterocyclic part of the compounds. The gene *C* (lemon-yellow self colour when homozygous) can produce both FG and AC, but the latter only when compounds with three –OH groups in the B ring are formed. The gene C^r (self-coloured pale pink when homozygous) also produces FG and AC, but the former are synthesized in detectable amounts only when no compounds with the trihydroxy structure are formed. In c^u plants none of these compounds is formed. In *sh* plants no LA are formed and the production of AC and FG is usually low. The gene *Sh* (glossy, cream-coloured seeds, becoming brown on storage) leads to the formation of LA and stimulates the production of the AC and FG formed as a result of *C* or C^r. Whether the simultaneous formation of these pigments leads to an increase or decrease in the amount of LA seems to depend upon the number of –OH groups in the B ring (controlled by Vv^{lae}). To explain this, it is assumed that the pigments and the leucocompounds are formed by parallel synthesis from the same precursor, or from precursors differing only in the number of –OH groups in the benzene ring which afterwards forms the B ring of the flavonoid compounds.

1059 Nakayama, R.
Genetical studies on kidney beans (*Phaseolus vulgaris*) III. On the inheritance of chlorina—a type of chlorophyll deficiencies.
Bull. Fac. Agric. Hirosaki Univ. 1959 : No. 5 : 1–5.

Chlorina, a type of chlorophyll deficiency which appeared in the F_2 of the cross Premier x Evergreen, was found to be determined by a single recessive gene designated *chl* [cf. XXIX, 3248 and 3249].

1060 Nakayama, R.
Genetical studies on kidney beans (*Phaseolus vulgaris*) IV. On the inheritance of hypocotyl color.
Bull. Fac. Agric. Hirosaki Univ. 1959 : No. 5 : 6–13.

Data on crosses of three varieties possessing green hypocotyl, Evergreen, Kintonmame and Chlorina 3, with other varieties which have pink or red hypocotyl suggest that in the Evergreen type an inhibitory recessive gene i_e is present. This gene inhibits the action of v_{lae} on the hypocotyl and of *V* on the hypocotyl and testa.

The gene pair *C c* influences testa colour and according to previous work [cf. XVIII, 2559] the heterozygous condition produces a marbled testa. The data from certain crosses in the present study indicate very strong linkage between *C* and I_e.

The suggested genotypes of the varieties used in this investigation are as follows: Evergreen, Kintonmame and Chlorina 3, $PTVci_e$; Premier, Sanpaku and Akasando [Red Triple], PTv_{lae}. CI_e; Kurotenashi, $PTVCI_e$; Blue Butter, $PTVcI_e$ [cf. XXIX, 3248].

1061 Nakayama, R.
Genetical studies on kidney beans (*Phaseolus vulgaris*). V. On the inheritance of seed-coat color 1.
Hirosaki Daigaku Nogakubu Gakujutsu Hokoku/Bull. Fac. Agric. Hirosaki Univ. 1960 : No. 6 : 21–36.

Data from crosses of Evergreen with Sanpaku, Premier and Kurotenashi indicated that i_e inhibits *V*, *B* and *G* with respect to their action upon seed-coat pigmentation. Alternatively, I_e may be considered as a basic gene essential for pigmentation due to the action of these three genes. Very strong linkage was detected between i_e and *c*. The parental varieties are given the following genotypes, the phenotype descriptions conforming with those used by

Lamprecht: Evergreen (cartridge buff), *PP cc* $i_e i_e$ *JJ gg bb VV*; Sanpaku (primrose yellow), *PP CC* $I_e I_e$ *jj gg bb* $v_{lae} v_{lae}$; Premier (buffy citrine), *PP CC* $I_e I_e$ *JJ gg BB* $v_{lae} v_{lae}$; and Kurotenashi (black), *PP CC* $I_e I_e$ *JJ GG BB VV* [cf. XXIX, 3248].

1062 Deshmukh, N. Y.
A sterile mutant in mung (*Phaseolus aureus*, Roxb).
Nagpur agric. Coll. Mag. 1960 : **34** : p. 28.

An individual plant of EB3 was observed at the Agricultural Research Institute, Nagpur, which differed from other plants of this variety in having roundish leaflets with a serrated leaf margin, instead of ovate leaflets with an entire margin. The plant flowered but bore no pods.

1063 Zaumeyer, W. J., Thomas, H. R. & Afanasiev, M. M.
A new disease-resistant Great Northern bean.
Phytopathology 1960 : **50** : p. 574. (Abst.).

Great Northern 1140 has been derived from a cross between Great Northern UI123, a mosaic-resistant variety, and US 5 Pinto, a rust-resistant type. It is resistant to many of the 30 reported races of bean rust as well as being immune to common bean mosaic and the New York 15 strain of that disease. Because of certain growth characteristics it is also likely to escape damage from *Sclerotinia* wilt. Under commercial conditions in Idaho, it has outyielded other Great Northern varieties by 350–500 lb. per acre. It is also adaptable to the bean-growing areas of Nebraska, Montana and Wyoming.

1064 Vieira, C.
Rico-23, nova variedade de feijão prêto para a Zona da Mata, Minas Gerais. **(Rico-23, a new variety of black bean for the Zona da Mata, Minas Gerais).**
Ceres, Minas Gerais 1959 : **11** : No. 61 : 22–26.

The above variety, a black-seeded form introduced from Costa Rica, is recommended for local use on account of its high yield and resistance to fungous diseases.

1065 Vieira, C.
Manteigão fôsco-11, variedade de feijão para a Zona da Mata, Minas Gerais. **(Dark butter bean - 11, a variety of bean for the Zona da Mata, Minas Gerais).**
Ceres, Minas Gerais 1960 : **11** : No. 62 : 98–102.

The above variety is a high-yielding brown-seeded form resistant to anthracnose and rust but susceptible to *Meloidogyne* sp. and *Isariopsis griseola*.

1066 Cardona, C., Camacho, L. H. & Orozco, S. H.
Diacol Nima, variedad mejorada de fríjol. **(Diacol Nima, an improved French bean variety).**
Bol. Divulg. DIA Bogotá 1959 : No. 8 : Pp. 24.

Developed at the Palmira Agricultural Experimental Station from Peró 5 x Algarrobo, the dwarf variety Diacol Nima outyields other commercial varieties, particularly under conditions of drought, and resists leaf diseases.

1067 Spencer, R. T. & Tindale, E.
Production of field beans.
Agric. Gaz. NSW 1960 : **71** : 287–95.

Two recent introductions from the USA which have shown promise in the northern region of New South Wales are Sanilac [cf. XXVII, 3564 and 3569] and Corvette. Corvette is an early-maturing erect Navy bean.

1068 Kaplan, L. & MacNeish, R. S.
Prehistoric bean remains from caves in the Ocampo region of Tamaulipas, Mexico.
Bot. Mus. Leafl. Harv. 1960 : **19** : 33–56.

Pod remains of a primitive type of *Phaseolus coccineus*, probably uncultivated, have been identified in the lowest levels in the above caves, dating from about 7500–9000 years ago, and also in levels dating from 4300–6000 and 3800–4300 years ago. *Ph. vulgaris* occurred at the 4300–6000 level and above, appearing earlier than maize but later than squash; the three distinct types found appeared in both early and late levels but seem to have been only sparingly cultivated during the earlier cultures. *Ph. lunatus* of the Sieva type was present from 500 to 1800 years ago but was rare.

1069 Nirad K. Sen & Manas Jana
Asynaptic black gram (*Phaseolus mungo* Linn.).
Sci. & Cult. 1960 : **25** : 537–38.

One plant from an X-irradiated seed lot was asynaptic, most of the PMCs containing only $1\text{–}6_{\text{II}}$ at metaphase I. The precocious movements of univalents often resulted in more than two groups at telophase I. The plant was completely ♂ and ♀ sterile.

1070 Kovalev, V. N.
(Introduction of *Phaseolus vulgaris* as a field crop in the Nonchernozem belt).
Trud. Belorussk. sel'skohozjajstv. Akad. (Trans. White Russ. agric. Acad.) 1959 : **32** : 87–112. [Russian].

Northward expansion of the cultivation of *Phaseolus* and the results of varietal trials in different places on Soviet territory are discussed. Many older and recent varieties had high yields and growth periods adapted to cultivation south of the rough imaginary line drawn between Leningrad and Aleksandrovsk in Sahalin. Further north the existing varieties did not ripen seed, but developed edible pods in the open or under glass.

1071 Mancini M., S. & Castillo D., M. A.
Observaciones sobre ensayos preliminares en el cultivo asociado de fríjol de enredadera y maíz. **(Observations on preliminary trials on the cultivation of the climbing bean in association with maize).**
Agricultura trop. 1960 : **16** : 161–66.

Ecuador 51 was far superior to 23 other varieties of the climbing French bean and one scarlet runner in trials with the maize variety Diacol 551 at Tibaitatá, Colombia. Use of this variety was associated, however, with low yields of maize. Correlation data indicated that although the yield of a climbing bean variety is not a function of its height, both tall growth habit and high-yielding capacity in climbing beans are associated with low maize yields.

1072 Quadling, C.
Mutation conferring streptomycin resistance in *Xanthomonas phaseoli*.
Canad. J. Microbiol. 1960 : **6** : 387–96.

Mutation conferring resistance to high concentrations of streptomycin occurred spontaneously at an over-all rate of about 3×10^{10} per bacterium per generation. Most mutants were streptomycin indifferent, but some were dependent and others partially dependent on the drug. In most cases the acquisition of resistance had no effect upon virulence on bean.

1073 Vieira, C.
As doenças do feijoeiro (*Phaseolus vulgaris* L.) na Zona da Mata, Minas Gerais. **[The diseases of the bean (*Ph. vulgaris* L.) in the Zona da Mata, Minas Gerais].**
Ceres, Minas Gerais 1960 : **11** : No. 62 : 73–91.

This survey of bean diseases in the above region includes data on varietal resistance. Varieties resistant to *Colletotrichum lindemuthianum* include Manteigão Fôsco [Dark butter bean], Manteigão Lustroso [Glossy butter bean], Manteigão Prêto [Black butter bean], two strains of Prêto Sessenta Dias [Black Sixty Days], Baetão Manteiga–41, Perry Marrow, 51 and Rico–23; to *Uromyces phaseoli*, Manteigão Prêto, Português–27 [Portuguese 27], Perry Marrow, Manteigão Fôsco, Manteigão Lustroso, Prêto Sessenta Dias–52, Baetão Manteiga–41, 54 and 51; and to *Erysiphe polygoni*, varieties of the Mulatinho [Mulatto] and Prêto Miúdo [Small Black] types.

1074 Bercks, R.
Serologische Untersuchungen zur Differenzierung von Isolaten des *Phaseolus*-Virus 2 und ihrer Verwandtschaft mit *Phaseolus*-Virus 1. **(Serological investigations on the differentiation of isolates of *Phaseolus* virus 1 and their relationship with *Phaseolus* virus 2).**
Phytopath. Z. 1960 : **39** : 120–28.

Four strains of *Phaseolus* virus 2 isolated from different host plants could be serologically differentiated if partially purified virus preparations were used. Differences were often detectable to a certain extent from a comparison of the homologous and heterologous titres; the two most strongly differentiated strains gave 1/62 and 1/75 of the homologous titres in cross reactions. All four isolates could be differentiated on the basis of absorption tests. Infection tests and a comparison of symptom expression permitted a partial distinction between isolates. Cross reactions between virus 1 and virus 2 confirmed the relationship between them.

1075 Kovalev, V. N.
(The response of some *Phaseolus* varieties to length of day).
Trud. Belorussk. sel'skohozjajstv. Akad. (Trans. White Russ. agric. Acad.) 1959 **32** : 113–24. [Russian].

Kirgizian studies on photoperiodism in *Phaseolus* showed that the common classification of varieties as short-day, long-day and day-neutral plants is inadequate. Short-day varieties flowered earlier in 10-hr. days than in normal days of 14–15 hr., but some of them delayed flowering in 24-hr. days in comparison with normal days, whereas others flowered at the same time in long as in normal days. Similar differences in response to short days were observed among the long-day varieties. Some flowered earlier in 24-hr. days than in normal days and later in short days and some varieties were neutral in respect of short days but flowered earlier or later in 24-hr. days than in 14–15 hr. days.

1076 Wester, R. E.
Resistance to stem anthracnose of lima beans.
Phytopathology 1960 : **50** : 573–74. (Abst.).

Resistance to *Colletotrichum truncatum* has been found in two recent introductions, PI 199,791 from British Guiana and PI 186,984 from South Africa. They will be crossed with standard commercial varieties such as Fordhook 242 and Thaxter.

1077 Acosta, J. C. & Petrache, L. M.
The transfer of the bushy character from cowpea (*Vigna sinensis* [Linn.] Savi) to sitao (*Vigna sesquipedalis* Fruw.).
Philipp. Agric. 1960 : **43** : 535–47.

Progress in combining the bush habit, early maturity and shortness of pods of the cowpea with the pod tenderness of *V. sesquipedalis* in high-yielding selections is reported from the Central Experiment Station, University of the Philippines.

1078 Mital, S. P., Singh, H. B. & Thomas, T. A.
Pick your cow-pea.
Indian Fmg. 1960 : **10** : No. **4** : 17–18, 37.

Details are given of American and local varieties of *Vigna sinensis* recommended for cultivation in various parts of India. The list includes a new Indian variety, K397, which was selected from an old collection of cowpeas at the Agricultural Station at Karnal. The variety shows good vegetative growth and medium-early flowering. Yields are higher than those of any other variety belonging to the same maturity group. It forms a good combination with maize in spring sowings.

1079 Veeraswamy, R.
Madras gets a new horse-gram.
Indian Fmg. 1960 : **10** : No. **3** : 8–9.

Developed by the Madras Agriculture Department from a selection from a variety from the Ramanathapuram district, *Dolichos biflorus* 'Co. 1' is a semierect type outyielding local varieties by 25–50%.

1080 Washko, J. B.
Soybean varieties for forage and grain in Pennsylvania.
Bull. Pa. agric. Exp. Sta. 1960 : No. 666 : Pp. 9.

A report is given of the results of an evaluation of varieties for forage or grain, mainly at two centres, during 1951–56.

1081 Voigt, R. L. & Weber, C. R.
Effectiveness of selection methods for yield in soybean crosses.
Agron. J. 1960 : **52** : 527–32.

Segregating populations from five crosses involving Harosoy, Hawkeye, Adams, Lincoln and Clark were utilized in the evaluation of three selection procedures for seed yield, maturity, height and lodging resistance. The results indicated that F_5 lines selected by a form of early-generation (F_4) replicated yield evaluation were superior in yield to those selected by bulk and pedigree methods. The lines selected by the early-generation method were similar in maturity and height and superior or equal in lodging resistance to those selected by the bulk and pedigree methods.

1082 Tedoradze, S. G.
(Promising soya-bean varieties from Georgia).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. **4** : p. 73. [Russian].

Three new cultivars are reported from the Georgian breeding station. Hybrids 1 and 10/53 are high-yielding forage types with growth periods 15–25 days shorter than the standard Imeretinskaja. They were obtained by pollinating Imeretinskaja with the pollen of a semicultivated form. Kolhida 4 (Gurijskaja x Imeretinskaja) yields 4–6 c. more beans per ha. than Imeretinskaja.

1083 Rattray, A.
The soya bean in Rhodesia.
Rhod. agric. J. 1960 : **57** : 179–85.

A note on varieties suitable for Rhodesia and Nyasaland is included.

1084 Dunleavy, J.
X-ray irradiation of soybean seed as a technique for production of disease-resistant plants.
Proc. Ia. Acad. Sci. 1959 : **66** : 113–22.

X irradiation of dry seeds of Hawkeye was without effect on germination, but above 15,000 r. damaged the apical meristem. There were slight leaf malformations at 7500 r. and plant height was greatly reduced at 10,000 r. The R_2 from the 15,000 r. treatment included stunted, bluish-green plants resistant to *Diaporthe phaseolorum* var. *caulivora*, but both the abnormal appearance and the resistance disappeared in the course of seven generations.

In the R_1 from the 10,000 r. treatment, two stunted, bluish-green plants proved immune from *Pseudomonas glycenea*, and in these plants, too, resistance decreased and appearance improved in successive generations; one line from each plant, however, was less susceptible in the R_7 than the control.

1085 Tasugi, H. & Mogi, S.
(The development of the lesions and the mechanism of resistance in soya beans infected by *Sphaceloma glycines*).
Nihon Shokubutsubyori Gakkai Ho/Ann. phytopath. Soc. Japan 1958 : **23** : 159–64. [Japanese].

A comparative study of four resistant varieties, four partially resistant varieties and three susceptible varieties is reported. In resistant varieties, the infecting hyphae do not pass beyond the epidermal cells and, in actively growing leaves, a layer of cork is formed beneath the locus of infection.

1086 **Soybeans are being bred to resist: soybean cyst nematode, root and stem rot.**
Agric. Res., Wash. 1960 : **9** : No. 1 : 12–13.

Transference of resistance to cyst nematode (*Heterodera glycines*) to Lee, Hill, Clark, Scott and Harosoy is under way in the USA. Resistance is probably controlled by three recessive genes. Using Blackhawk as source of resistance, progress was also made in breeding for resistance to *Phytophthora* rot.

1087 Dropkin, V. H. & Nelson, P. E.
The histopathology of root-knot nematode infections in soybeans.
Phytopathology 1960 : **50** : 442–47.

Studies on the resistance of 19 soya-bean varieties to *Meloidogyne incognita incognita* and *M. incognita acrita* showed this to be expressed in the response of the host cells to the parasite [cf. XXIX, 3264]. Four types of giant cells are described; types 1, 2 and 3 are associated with poorly developed parasites with few eggs while type 4 is associated with rapid growth of the parasite and abundant egg production. Varieties differed widely in the frequency of occurrence of type 4 cells.

Infection of Richland and S–100 with *M. arenaria arenaria* showed that great mitotic activity precedes giant cell formation in the former while little mitotic activity was found in the resistant S–100.

1088 de Haan, H.
Selectie in een jong stadium. **(Selection at a young stage).**
Meded. Ned. Alg. Keuringsdienst Landbouwzaden Aardappelpootgoed 1960 : **16** : 101–02.

In this review of characters which can be selected at an early stage in various crop plants, the author's own observation that selection for height can be effected in young pea seedlings is mentioned.

1089 Gottschalk, W. & Weilung, F.
Über die Ursachen der Chimärenbildung nach Samenbestrahlung bei *Pisum sativum*. **(On the causes of chimera formation after seed irradiation in *P. sativum*).**
Naturwissenschaften 1960 : **47** : 115–16.

The X_2 generation from the pea 'Dippes gelbe Viktoria' [Dippe's Yellow Viktoria] contained a variety of mutants, 142 of which were studied. It was calculated that only 10·6% of the genes were mutated; the proportion in the X_3 was 12·1%. These figures deviate significantly from the mutant frequency of 20% which was established in the segregating families of later generations and it is concluded that the majority of the X_1 plants had arisen from two initial cells, one mutated and the other not. As the cultivar in question normally arises from a single initial cell, it is assumed that the mutations have occurred on only one of the two chromatids.

1090 Gottschalk, W. & Scheibe, A.
Untersuchungen an röntgeninduzierten Mutanten von *Pisum sativum*. **(Investigations on X-ray induced mutants of *P. sativum*).**
Z. Pflanzenz. 1960 : **42** : 313–38.

Eleven mutants obtained by X irradiation of dry seeds with doses of 5,000–15,000 r. are described. They include three chlorophyll variants, some dwarfs and others with leaf abnormalities; some mutants were fertile and others sterile. In one case the differentiation of the growing point was suppressed. One female sterile mutant differed from the original material in seven characters and others also varied in more than one character; in some cases a pleiotropic gene may have mutated. None of the mutants are of breeding value but the fertile ones may be used in genetical studies. The mutation rate was 2·1% calculated with reference to the percentage of surviving plants in the X_1 generation but only 1% in relation to the total number of seeds irradiated.

1091 Gottschalk, W.
Untersuchungen über die genetischen Grundlagen der Blütenmorphologie. **(Investigations on the genetic basis of flower morphology).**
Naturwissenschaften 1960 : **47** : 114–15.

Among some 300 mutants produced by X irradiation of peas, 41 involved changes in floral structure; most of the mutant genes have a pleiotropic action and some of them affect the leaf and other organs as well as the flower. When genes reported by other authors are also considered, it is calculated that over 100 dominant genes are required to produce normal flowers.

1092 Prüter, A., Heydel, H. & Engelmann, C.
Zur Unterscheidung von Hödinger und Baltersbacher Erbsen. **(On distinguishing the Hödinger and Baltersbacher peas).**
Z. Landw. Vers.-UntersuchWes. 1959 : **5** : 282–90.

The seeds of these two varieties of fodder pea are sometimes difficult to distinguish and a full description is given of their characteristics. One of the main distinguishing features is a small protrusion, known as the spermotylium, in the vicinity of the hilum, which is shaped like a comb in the Hödinger and almost spherical in the Baltersbacher pea. Certain differences in the stipules and other organs of the growing plant are also indicated. The Hödinger type bred true to type but segregation was often observed in the progenies of the Baltersbacher type.

1093 Gottschalk, W.
Über züchterisch verwendbare strahleninduzierte Mutanten von *Pisum sativum*. **(On radiation-induced mutants of *P. sativum* usable in breeding).**
Züchter 1960 : **30** : 33–42.

About 350 mutants were produced during five years' experiments in which dormant seed was irradiated with X-ray doses of 5000 to 15,000 r. Three of the mutants appear to be of breeding value. The mutant 46/57 begins to flower about 10 days before the original form Dippes gelbe Viktoria [Dippe's Yellow Viktoria] and also ripens its seed earlier. The lowest pods of this form develop on the 4–6th node whereas those of the original variety form on the 10–16th node. The mutant produces a much lower yield than the normal form and also shows floral abnormalities which do not affect fertility. Mutant 66/58 has a maximum internode length of 3 cm., whilst that of the normal form is 6·5. Mutant 56/57 also has shortened internodes but differs from 66/58 and the normal form, producing its longest internodes in a later stage of ontogenesis. The two short mutants have good standing capacity. In each mutant a single recessive gene is responsible for the abnormalities.

1094 Attia, M. S.
Natural pollination in peas in Egypt, its extent and nature.
Alexandria J. agric. Res. 1958 : **6** : No. 2 : 93–98.

Using flower colour as marker, no evidence of natural crossing was obtained for any of the seven varieties sown in rows 30 in. apart at the Vegetable Research Station, Dokki, near Cairo. The anthers dehisced one to six days before the stigmas were exposed to pollen from any other source. Bagging is therefore considered unnecessary in selfing at this station.

1095 Atabekova, A. I.
(Studying embryology in the pea).
Izv. timirjazev. sel'skohozjajstv. Akad. (News Timirjazev agric. Acad.) 1960 : No. 2 : 177–82. [Russian].

This review of cytoembryological research on *Pisum sativum* refers to unscientific methods employed by Kozlov and more recently by Vasileva in experiments intended to prove "cytoplasmic fertilization" [cf. XXIV, 3490]. In the writer's view it does not occur.

1096 Lockwood, J. L. & Ballard, J. C.
Evaluation of pea introductions for resistance to *Aphanomyces* and *Fusarium* root rots.
Quart. Bull. Mich. agric. Exp. Sta. 1960 : **42** : 704–13.

Just over 800 accessions of *P. sativum* were tested for reaction to an isolate of *A. euteiches* in the greenhouse. According to a scale of 0–8, with 0 indicating healthy plants and 8 dead plants, only 18 introductions had ratings of less than 5; none was graded 0 or 1. In tests for reaction to an isolate of *F.* (*Hypomyces*) *solani* f. *pisi*, 69 out of 793 accessions were rated 1–3; no introduction was immune.

1097 Lockwood, J. L.
Pea introductions with partial resistance to *Aphanomyces* root rot.
Phytopathology 1960 : **50** : 621–24.

Greenhouse trials have shown that the level of resistance to *A. euteiches* is lower in the commercial varieties Miragreen and Early Perfection than in the following introductions: PI 166159, 167250, a selection of 169604, 180693, 180702, 180868 and 184129. Several of these consistently gave resistant reactions when tested under variable conditions, the varying factors being zoospore concentration, age at which plants were inoculated, sand temperature, age of culture and isolate of the pathogen. One of the four isolates of *A. euteiches*, isolate 102, appeared to be pathogenically distinct from the other isolates.

1098 Ewing, E. E.
Factors for resistance to pre-emergence damping-off in pea (*Pisum sativum* L). incited by *Pythium ultimum* Trow.
Diss. Abstr. 1959 : **20** : LC Card Mic 59–5304 : p. 1518. (Abst.).

The resistance shown by several varieties to preemergence damping-off, chiefly due to *P. ultimum*, depended upon the presence in the testa of the basic gene of *A* for anthocyanin. Seeds with *A* testas were resistant regardless of whether the cotyledons were round (*R*), wrinkled (*r*), yellow (*I*) or green (*i*). When the seeds had *a* testas, the degree of susceptibility was greatly influenced by *Rr*, wrinkled seeds being much more susceptible than round ones borne in the same pods. No exceptions were found to this rule, although the degree of superiority of *R* over *r* seeds was dependent upon the pedigree. Susceptibility of seeds with *a* testas was also affected by *Ii*, yellow seeds giving better stands than *i* seeds borne in the same pods. Evidence from the effects of three gene pairs, *Aa*, *Bb* and (?) *Mpmp* upon resistance showed that this property was intimately associated with the presence of tannin-like colourless phenolic compounds in the testa, compounds of delphinidin probably being involved. The same type of phenolic compound associated with resistance to preemergence damping-off is probably also responsible for the darkening upon cooking and astringent taste characteristic of seeds with *A* testas.

1099 King, T. H., Johnson, H. G., Bissonnette, H. & Haglund, W. A.
Development of lines of *Pisum sativum* resistant to *Fusarium* root rot and wilt.
Proc. Amer. Soc. hort. Sci. 1960 : **75** : 510–16.

About 150 varieties and selections of canning and garden peas were evaluated for resistance to *F. oxysporum* f. *pisi* and *F.* (*Hypomyces*) *solani* in field nurseries at two centres in Minnesota during two years. Except for a selection of unknown origin, all entries equalled or exceeded the standard canning variety Perfected Wales in susceptibility, this variety being resistant to race 1 and susceptible to race 2 of *F. oxysporum* f. *pisi*. Of the 391 accessions of *P. sativum* then tested, eight were chosen for further study on the basis of survival compared with that of Perfected Wales. Lines were selected within these collections which possessed more resistance to *Fusarium* root rot and wilt than commercial canning varieties. Crossing between selected plants of the lines resulted in progeny with more resistance than the initial selections. Further hybridization between derivatives of these crosses yielded progeny with still better resistance, combined with plant and seed characteristics desired in canning peas. It is considered that the material thus developed has resistance to a wider range of pathogenic races of *F. oxysporum* f. *pisi* than hitherto. The generalized field resistance to *Fusarium* root rot and wilt may involve several genes.

1100 Aziz, M. A., Khan, M. A. & Siraj-ud-Din Shah
Causes of low setting of seed in gram (*C. arietinum*).
Agriculture, Pakistan 1960 : **11** : No. 1 : 37–48.

Marked differences in seed setting percentage were noted among five varieties of *Cicer arietinum* subjected to early sowing, irrigation and fertilization treatments. Pollen grains did not germinate when kept at 50–75° F. but germination was found to be quite normal at a constant temperature of 77° F. in an incubator.

1101 Valenta, M., Kutáček, M., Icha, F. & Šírková, V.
Některé obsahové látky různých odrůd čoček (*Lens esculenta* Moench), čočáků (vikví s čočkovitými zrny—*Vicia sativa* var. *segetalis* a var. *cordata*) a vikve čočkové (*Ervum ervilia* L.). **[Some substances contained in different varieties of lentil (*L. esculenta* Moench), vetches with lentil-like seeds (*V. sativa* var. *segetalis* and var. *cordata*) and lentil vetch (*E. ervilia* L.)].**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 679–88.

Tabulated data are provided on the occurrence of free and bound aminoacids in these three species and on their contents of total nitrogen, pure protein, ash and reducing sugars. Some differences between species and between varieties within species are noted.

1102 Shepherd, K.
Genetics of testa color in *Canavalia ensiformis.*
J. Hered. 1960 : **51** : 68, 76.

Uniform brown testa pigment was found to be due to the complementary action of two dominant genes, *S* and *E*, for which white seeded plants are recessive. Intermediate phenotypes result from the separate action of these genes as follows: spotted, seeds spotted with brown in a characteristic lateral and dorsal pattern, *SSee*; ellipse, seeds brown except for a white ellipse around the hilum, *ssEE*; and ragged, similar to the preceding but the ellipse is larger and less definite and the brown area is flecked with white, *ssEe*. Pigment intensity was variable, but no genetic basis for this was found.

From a small sample of plants it appeared that the gene pair *Ss* also controlled a difference in flower colour. The flowers of *S* plants were uniformly red-purple, while those of *ss* plants were whitish towards the base. The testa colour inheritance described here is considered to be analogous with that reported by Smith for *Vigna sinensis* [cf. XXVII, 958], involving the restrictive genes Watson (*W*) and Holstein (*H*).

1103 Deshmukh, N. Y. & Rekhi, S. S.
Inheritance of leaf in pigeon-pea—*Cajanus calan* (L.) Millsp.
Curr. Sci. 1960 : **29** : 237–39.

According to the results from crosses involving the mutants *unifoliata* (unifoliate pointed leaf) and *oval-oblong trifoliata* (trifoliate leaf with roundish apices) [cf. XXX, 919] and two varieties bearing trifoliate leaves with pointed apices, the trifoliate condition is monogenic and dominant over the unifoliate, while the pointed apex is dominant over the roundish and also monogenic. The two gene pairs segregated independently.

1104 Pathak, G. N. & Jaimangal Sahai
Type 7. A new arhar for mixed cropping in Kharif.
Indian Fmg. 1960 : **10** : No. 2 : p. 37.

Selected from material from Lucknow, *Cajanus cajan* 'Type 7' is a later-ripening, erect, brown-seeded variety suitable for all districts in Uttar Pradesh. It has a 1000-seed weight of 120 g., as against 74 g. for T17 and 81 g. for T105.

1105 Buchert, J. G.
The application of a nuclear-cytoplasmic genetic interaction in a new method of sweet corn seed production.
Proc. Pa. Acad. Sci. 1959 : **33** : 46–49.

A popular explanation is given of the principles of using cytoplasmic male sterility and fertility-restoring genes in hybrid seed production, special reference being made to the recently discovered restorer lines Wisc. 5 and NJ103 [cf. 1106].

1106 Buchert, J. G.
Chromogenic control of cytoplasmic male sterility in sweet corn.
Proc. Pa. Acad. Sci. 1959 : **33** : 50–54.

Among 48 inbreds studied at the Connecticut Agricultural Experiment Station, a variable ability to restore fertility to cytoplasmically male-sterile (ms_1) sweet corn was found in eight and a good ability in Wisc.5 and NJ103 (from P39 x NJ7y). Wisc.5 was homozygous for a dominant restorer gene epistatic to the sterility-inducing factor. NJ103 was heterozygous for a restorer gene, while in another line, Yellow Vanguard, several restorer genes were involved. In Yellow Vanguard, the degree of restoration was shown to depend upon the genotype of the sterile female, and in the restorer lines P14, P39 and NJ143y, restoration was also affected by environment. One line, C31, appeared to be recessive for the fertility-restoring character.

1107 Murray, M. J.
The genetic basis for the conversion of menthone to menthol in Japanese mint.
Genetics 1960 : **45** : 925–29.

Hybridization between Japanese mint, *Mentha arvensis* var. *piperascens*, with the genotype *ccRr* and a spearmint strain of *M. crispa* with genotype *Ccrr* gave rise to 99 carvone, 52 menthone and 55 menthol individuals, indicating that the dominant allele *R* controlling conversion of menthone to menthol could not convert carvone to menthol. However, the spearmint individuals from this cross were of two types, one with a strong carvone odour and the other with a weak carvone odour; plants in the latter class were therefore assumed to have converted a high percentage of the carvone to its related alcohol. From these results it is suggested that *R* activates an enzyme which reduces menthone to menthol; that *r* functions similarly but less efficiently; and that the gene is probably specific for the reduction process rather than for the basal substance, the ketone.

An independently-inherited ketone factor *A* is not considered here since it is not segregating [cf. 1108].

1108 Murray, M. J.
The genetic basis for a third ketone group in *M. spicata* L.
Genetics 1960 : **45** : 931–37.

Strains of *M. crispa* and *M. spicata* with the genotype *CcAa* and the ketones carvone and dihydrocarvone have a spearmint odour, but their selfed progenies segregate to give 12 carvone-dihydrocarvone : 3 menthone-pulegone : 1 piperitone-piperitenone. Individuals with genotypes *CCAA*, *CCAa* or *CCaa* are true-breeding spearmints and *ccAA* individuals are true-breeding for menthone and pulegone. Selfed plants with *CcAA* segregate 3 spearmint : 1 menthone-pulegone, while those with *Ccaa* segregate 3 spearmint : 1 piperitone-piperitenone.

The musty odour of *M. longifolia* is that of its principal ketone, piperitone oxide; this species also has small amounts of piperitenone oxide. The pineapple-like odour of *M. rotundifolia* is that of the principal ketone piperitenone; small amounts of piperitone are also present. Both species breed true and have the genotype *ccaa*. Genes *C* and *A*, together with the gene or genes controlling the relative amounts of related ketones, thus determine the development of all the six major ketones known in this genus.

1109 Berry, S. Z.
Determination of levels of *Verticillium* wilt resistance in mint.
Phytopathology 1960 : **50** : p. 569. (Abst.).

A method of determining mint resistance to *V. albo-atrum* is described. Resistance to the pathogen was found in the following six types (in increasing order of resistance); *Mentha piperita*, *M. spicata*, *M. piperita* x *M. crispa* hybrid clones 148, 161 and 185, and *M. crispa*. It was found that clones with moderate to high resistance recovered from initial symptoms; the rapidity of recovery was related to the inherent level of resistance.

ECONOMIC LOWER PLANTS

1110 Lojcjanskaja, M. S. & Safronova, L. E.
(On the phylogenetic relationships of acetic acid bacteria).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 336–42. [Russian].

The data presented show that the capacity to convert ethyl alcohol to acetic acid aerobically is possessed by some species of *Acetobacter*, referred to as the group *mesoxydans*, and by species of *Pseudomonas*. This, together with certain other similarities reported, leads to the conclusion that the group *mesoxydans*, which includes the industrial species *A. aceti* and *A. xylinum*, is phylogenetically more closely related to *Pseudomonas* than is the group *suboxydans*. No grounds are recognized for separating *suboxydans* as a separate genus, *Acetomonas*, and the whole genus *Acetobacter* is considered as forming part of the family Pseudomonadaceae, within which *Acetobacter* has evolved in the direction of acidification and growth in an acid medium, and *Pseudomonas* in the direction of ammonification and growth in an alkaline medium.

1111 Iorkiewicz, Z.
Z zagadnień zmienności i genetyki *Rhizobium*. **(Problems of variation and genetics of *Rhizobium*).**
Acta Microbiol. Polon. 1959 : **8** : 225–33.

The literature on the subject is reviewed briefly.

1112 Marszewska-Ziemięcka, J.
Z zagadnień cytologii i fizjologii *Rhizobium*. **(Problems of the cytology and physiology of *Rhizobium*.)**
Acta Microbiol. Polon. 1959 : **8** : 209–23.

The literature on the subject is reviewed.

1113 Schiel, E., De Olivero, E. G. & Yepes, M.
Selección de bacterias radicícolas. **(Selection of root nodule bacteria).**
Idia 1960 : No. 150 : 44–50.

This review discusses the methods employed in the Institute of Microbiology and Agricultural Industries in Buenos Aires for the selection of improved strains of *Rhizobium*.

1114 Verbina, N. M.
(The respiration of *Aspergillus nidulans* variants greatly modified by ultraviolet rays).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 190–94. [Russian].

Endogenic respiration and oxidative capacity in respiration-deficient mutants, which arose after ultraviolet treatment, were restored to normal by growing them in submerged culture under rapidly revolving conditions in a complete nutrient solution.

1115 Imšeneckij, A. A., Solnceva, L. I. & Kuranova, N. F.
(Experimental variability of *Aspergillus niger.* I. Morphological description of the variants induced by ultraviolet irradiation).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 177–83. [Russian].

Morphological and biochemical mutants of an industrial strain 6/5 were obtained by subjecting the initial culture to repeated treatments with ultraviolet rays followed by selection. They became constant in respect of new morphological characteristics after four irradiations and fourfold selection. Mutants T_1 and T_2 produced more citric acid than the initial strain.

1116 Imšeneckij, A. A., Solnceva, L. I. & Kuranova, N. F.
(Experimental variability of *Aspergillus niger.* II. Formation of citric acid by variants of *A. niger* produced by ultraviolet irradiation).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 351–57. [Russian].

A full description is given of the characteristics of the mutant strain T_1 and of the parent strain 6/5 [cf. XXIX, 4675 and XXXI, 1115]. The mutant has a smaller mycelium but an increased capacity for oxidizing both sucrose and citric acid; it nevertheless produces more citric acid in the medium than the original culture, the yield of citric acid per unit of sugar consumed being 51·5% in the mutant and 41·6% in the original strain.

1117 Verbina, N. M.
(On the respiration of a mutant of *Aspergillus niger* produced by ultraviolet irradiation).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 363–79. [Russian].

Studies of respiration in mutant T_1 of *A. niger* '6/5 H' [cf. 1116] were made by three separate methods. The respiration rate of the mutant was invariably higher than that of the parental strain, endogenous respiration in submerged cultures showing an increase of 11–22% and respiration in the presence of glucose 18–28%. In superficial cultures on a sugar solution the respiration of the mutant was 14% higher than that of the parent strain. The mycelial development was 25% less in the mutant but it nevertheless produced 24·6% more citric acid than the parent from the same amount of sugar.

1118 Kalbus, B. H.
Studies on the photoreactivation of spores of *Penicillium chrysogenum.*
Diss. Abstr. 1959 : **20** : LC Card Mic 59–5785 : p. 1993. (Abst.).

The relative frequency of variants requiring (1) yeast extract, (2) casein hydrolysate, (3) vitamins or (4) ammonium, isolated after ultraviolet irradiation + photoreactivation treatment, was significantly different from that obtained with ultraviolet irradiation alone. In particular the percentage of the fourth category of variants was less. When a period of incubation in the dark intervened between ultraviolet exposure and photoreactivation treatment, light did not have a significant effect upon the relative frequency of the four types of variants. The following hypothesis is suggested. "The initial effect of ultraviolet radiation may involve the formation of a mutagenic substance in the cytoplasm which then diffuses into the nucleus. Assuming that light acts quantitatively to destroy the mutagenic substance, it may be possible to explain the differential effect of light on mutation by assuming that the units responsible for heritable characters are each positioned more or less exactly in some part of the resting nucleus and, therefore, are not equally exposed to the action of the mutagenic substance."

1119 Hecht, W.
Studie über Primär- und Sekundärinfektionen bei der Kultur von *Claviceps purpurea* Tul. **(A study on primary and secondary infections in the cultivation of *C. purpurea* Tul.).**
Qual. Plant. Mater. veg. 1960 : **7** : 39–54.

Observations are reported on the size and weight of sclerotia on primarily and secondarily infected ears of rye varieties growing under various climatic conditions in Europe. Although the extent of secondary infection depends mainly on atmospheric conditions, varietal differences were also observed. Strains of *C. purpurea* differing in constitution also showed marked differences in the number of sclerotia and their weight.

1120 Laskowski, W. & Stein, W.
Unterscheidung verschiedener Inaktivierungseffekte an homozygoten Hefestämmen verschiedenen Ploidiegrades. **(Distinguishing different inactivation effects on homozygous yeast strains of different degrees of ploidy).**
Naturwissenschaften 1960 : **47** : 163–64.

A study was made of the inactivation of certain physiological processes by irradiation and other agencies applied to haploid and polyploid yeast strains that were otherwise genetically identical [cf. XXX, 65]. The diploid strain was found to increase in sensitivity with density of ionization [cf. XXX, 3358].

1121 SHULT, E. E. & DESBOROUGH, S.
The application, to tetrad-analysis-data from *Saccharomyces*, of principles for establishing the linear order of genetic factors.
Genetica 1960 : **31** : 147–87.

This is a full account of work already summarized [cf. XXX, 2116].

1122 PAPAZIAN, H. P. & LINDEGREN, C. C.
A study of irregular quadruplets in Saccharomyces.
Genetics 1960 : **45** : 847–54.

Data are provided on conversion and crossing over of four linked genes *ch*, *hi*, *is* and *an*, for choline, histidine, isoleucine and anthranilic acid requirements respectively, in four different families. It is concluded that alleles in the heterozygous state mutate to or are replaced by other alleles at a rate much higher than the spontaneous mutation rate, that the change is not random, and that neither polyploidy, polysomy nor somatic crossing over is involved. Regular meiotic crossing over appeared to be an independent phenomenon not correlated in any way with conversion.

1123 OGUR, M., OGUR, S. & ST. JOHN, R.
Temperature dependence of the spontaneous mutation rate to respiration deficiency in Saccharomyces.
Genetics 1960 : **45** : 189–94.

The temperature dependence of rate of cytoplasmic mutation to respiratory deficiency was investigated in five strains at 15° to 38° C. The strains exhibited typical dependence of growth rate upon temperature with Q_{10}s equal to or slightly greater than 2 at lower temperatures, maximum growth rate at 30° C. and diminishing growth rate at higher temperature. The curves for mutation rate were qualitatively comparable in that the rate exhibited a negative dependence on the lower range temperature, then passed through a minimum and showed a large positive dependence on the higher temperature range. Each strain had a characteristic pattern of instability. It is suggested that the minimum curves for temperature dependence of the mutation rate may be interpreted as representing the result of unbalanced growth at both low and high temperatures, such growth leading to an increase in the probability of the irreversible loss of a cytoplasmic component essential to the biosynthesis of the respiratory system.

1124 GALZY, P.
Variations génétiques de la levure au cours de la croissance sur l'acide lactique comme seule source de carbone. (**Genetic variations in yeast during growth on lactic acid as sole carbon source**).
CR Acad. Sci., Paris 1960 : **251** : 3719–21.

Adaptation of certain cultures of *Saccharomyces cerevisiae* to a medium containing lactic acid as the sole carbon source proved to be due, at least in part, to mass selection of mutants giving smooth colonies. The characters smooth and rough were both stable during vegetative multiplication, but the mutation "smooth" occasionally appeared in rough colonies during prolonged culture either in glucose or lactate medium. The reverse mutation from smooth to rough was found only once.

1125 ROYAN, S. & SUBRAMANIAM, M. K.
Differential fluorescence of the chromocenters and nucleolar equivalents of the yeast nucleus in acridine orange.
Proc. Indian Acad. Sci. : Sect. B. 1960 : **60** : 205–10.

In living cells of *Saccharomyces cerevisiae* stained with acridine orange at a dilution of 1 in 40,000, the intranuclear structures were distinguishable by their differential fluorescence. The chromocentres were green while the nucleolus was orange. The vacuole showed no fluorescence.

1126 LINDEGREN, C. C., SHULT, E. & DESBOROUGH, S.
The induction of respiratory deficiency by adaptational stress.
Canad. J. Genet. Cyt. 1960 : **2** : 1–10.

Genotype *CA* of *Saccharomyces* becomes adapted to the toxic effects of caffeine much more readily than genotype *ca* [cf. XXX, 931]. Evidence has been obtained that the high frequency of respiration-deficient cells produced by exposure of *ca* cultures to caffeine may be attributed to the indirect effect of the stress associated with adaptation and not to the direct effect of the substance upon respiration.

1127 TOLEDO, O. Z. DE, & TEIXEIRA, C. G.
Fermentação de mosto de uva com leveduras regionais selecionadas. (**Fermentation of grape must with local selected yeasts**).
Bragantia 1959 : **18** : 33–39.

Two Brazilian strains, *Saccharomyces cerevisiae* 'IA78' and 'IA199', achieve a satisfactory alcohol concentration and low values for volatile acids and acetaldehyde.

1128 DE BECZE, G. I.
Classification of yeasts. I. Introduction and morphology. II. Genetics. III. Biochemistry.
Wallerstein Labs. Commun. 1959 : **22** : 103–17, 199–225; 1960 : **23** : 99–124.

The author reviews information on the morphology, genetics and biochemistry of yeasts relevant to their classification and also outlines the development and present standing of yeast classification.

BOOK REVIEWS

1129 STEEL, R. G. D. & TORRIE, J. H.
Principles and procedures of statistics.
McGraw-Hill Book Company, Inc., New York, Toronto, London 1960 : 81s. 6d. : Pp. xvi + 481 : figs. : tables.

This book is intended mainly for agricultural and biological students taking postgraduate courses which include statistics as a supporting subject. In teaching their classes, the authors have three main aims: "first, to present the student with a considerable number of statistical techniques, applicable and useful in terms of research . . . second, to promote disciplined thinking on the part of the student with respect to the conduct of experiments . . . third, to promote disciplined thinking on the part of the student with respect to the analysis of experimental data".

Basic statistical concepts are usually new and difficult to students of any background and this is especially so when their mathematical training is limited. The authors have therefore presented the fundamentals at some length and have rightly stressed them by considerable repetition. In spite of this the reader is likely to find the all-important first few chapters very difficult for a number of reasons.

First, the order in which the ideas are introduced is likely to confuse the student unnecessarily. Reference has constantly to be made to future chapters in order to understand such important ideas as degrees of freedom and bias. Confidence and fiducial intervals requiring the use of Student's t are discussed in chapter 2 before the normal distribution has even been mentioned and even before the chapter on probability. Significance testing is introduced almost as an aside in the middle of a section on estimation; the logic of testing hypotheses is introduced in a chapter on sampling from a normal distribution and the reader may well be led to believe that normality is an essential feature. The idea of a linear additive model is introduced as early as p. 20 and whilst the authors pay considerable attention to models in later chapters it seems undesirable to introduce the concept at this stage.

Secondly, there is a lack of precise definition which is not likely to promote the authors' aim of "disciplined thinking". This may be inevitable to some extent if the limited mathematical ability of most readers is to be properly considered but terms such as independence and degrees of freedom should not be introduced without some discussion. Some points are well emphasized by means of example but others are relegated to exercises, the solutions of which are not given.

Thirdly, in a necessarily condensed course such as the authors have in mind it seems desirable to eliminate all nonessentials. For example, the introduction of average deviation as a measure of dispersion and the information that s is a biased estimate of σ are likely to assume undue importance in a reader's mind unless he already has some wider knowledge.

Fourthly, the arithmetic procedures may be found difficult to follow. The use of coding to simplify calculations is unduly stressed; it is now rare for research workers to have no calculating machine available. The use of suffices is inconsistent, even within a particular formula. There are some arithmetic errors in the examples and some of the histograms are inaccurately drawn. The practice of slightly changing original data so that the arithmetic mean takes an integer value (p. 24) or the distribution approximates more closely to normal (p. 50) seems entirely unnecessary; it is surely preferable to use data as they are rather than as one would like them to be.

Fifthly, the concept of significance testing is not easy to grasp, partly because of the manner in which it is introduced and partly because its logic is not always clear. The authors rightly state that the null hypothesis is not necessarily that the difference between the population parameters is zero, but the examples which they give without comment to illustrate the contrary (e.g. that a new variety of maize will outyield the standard by 5 bushels per acre) are rarely appropriate in practice; the method is particularly dangerous in the context of this book because the reader is often left with the impression that a nonsignificant difference leads to the conclusion that the null hypothesis can be accepted, rather than the weaker statement that there is no evidence from the sample to reject it. The authors adopt the usual practice of using 5% for the level at which the null hypothesis may reasonably be rejected but suggest that with small experiments this would mean that the null hypothesis would be rejected very rarely in practice and another choice of significance level, say 10%, might be chosen in such cases; the logic of this seems difficult to defend. The section on one- and two-tailed tests is unlikely to be fully appreciated by the practical research worker.

In the reviewer's opinion these weaknesses considerably reduce the value of the first part of the book but the later chapters are much clearer. The chapter on principles of experimental design is a useful exposition; the designs discussed, and the analyses appropriate to them, include factorials, Latin squares and split plots. There are also chapters on linear, nonlinear and multiple regression and correlation, analysis of covariance, X^2, some discrete distributions, nonparametric statistics and finally a brief chapter on sampling from finite populations. Random, fixed and mixed models are rightly discussed in some detail and components of variance are given so that the proper significance tests may be applied. The dangers of the method of the "least significant difference" for comparing means, which is still wrongly used by the majority of research workers, are pointed out, together with a description of the proper methods of multiple comparisons developed by Duncan and others.

There is no shortage of books which teach statistical methods at this level and it may be asked whether this work is a valuable addition. The answer in the reviewer's opinion is that it is unsuitable as an introduction to the subject but that it is comprehensive and up to date and may be a useful reference book. As the authors indicate in their preface, the extent to which any statistical method is used by agricultural and biological research workers depends on how extensively it was treated in their college course, few methods being learned later; the number of methods presented is therefore considerable and a student who survives a course taught at this level is likely to apply the methods described in a proper and useful way.

1130 Kendall, M. G. & Buckland, W. R.
A dictionary of statistical terms.
Oliver and Boyd, Edinburgh and London
1960 : 2nd Ed. : 32s. : Pp. xi + 575.

The first edition of this highly useful synopsis of statistical terms with its lists of equivalents in French, German, Italian and Spanish was published in 1957 [cf. XXVII, p. 588]. The present edition is identical with the first save for the addition of a combined table of statistical terms arranged in order of the English terms with the equivalents in the other languages arranged alongside. It is explained in an introductory note that the terms in the final table have been revised but that, in order to avoid resetting the existing type, these revisions have not been incorporated into the main text. It is to be hoped that the compilers will be able to effect a complete revision for the next edition and in particular to tighten up the cross referencing which is untidy in places. To take a single example, the combined table has entries in the English column both for D^2-*statistic* and *Mahalanobis' generalised distance.* In the list of English terms, the D^2-*statistic* is defined on p. 76 and the entry of p. 172 on *Mahalanobis' generalised distance* directs us to D^2-*statistic* on p. 76. The French inquirer will fare worse since, although *distance generalisée de Mahalanobis* is given as the equivalent for both of the English entries, neither this term nor any other obvious alternative appears in the list of French terms. The German reader will be more fortunate since he will find D^2-*Abstands-Masszahl*, the equivalent of D^2-*statistic*, in the list of German terms though he will not find *Verallgemeinerter Abstand* (*nach Mahalanobis*), the equivalent of *Mahalanobis' generalised distance.* The Italian inquirer will be more frustrated than the French since although the combined index holds out hope of finding either *costante campionaria* D^2 or *distanza generalizzata di Mahalanobis* in the list of Italian terms, he will in fact find neither. Finally the Spaniard is treated as the German and will find one equivalent in his list, *estadística* D^2, but not the other, *distancia generalizada de Mahalanobis.* One other point that calls for general overhauling is the apparently arbitrary partitioning of index numbers in the Romance languages between *numero indice* (taking Italian as the example) and *indice.*

The competence of the authors at the high mathematical level demanded by the subject matter of this book is everywhere evident. Should this be combined with similar competence in the humbler branch of applied mathematics involved in cross referencing, we should indeed have a notable volume.

1131 ERRERA, M. & FORSSBERG, A. (Editors).
Mechanisms in radiobiology. Volume II. Multicellular organisms.
Academic Press, New York and London 1960 : $13.00 : Pp. xiii + 395 : figs. : tables.

The five review articles composing this volume are principally concerned with the medical aspects of irradiation. The fourth article, however, Mechanisms of protective and sensitizing action, by L. Eldjarn and A. Pihl, is of more general biological interest since it reviews the highly controversial subject of the mode of action of radiation on living systems and the ways in which these effects can be depressed or enhanced by suitable reagents. The general conclusion reached by the authors is that these reagents have no common mode of action but can be grouped into several categories. The principal of these are: "radical scavengers", such as thiourea and fructose; substances reducing oxygen tension, such as sodium nitrite; substances affecting target radiosensitivity or cellular metabolism; compounds with a specific resonating structure, such as synkayvite, which react with target molecules; and lastly, substances such as cysteine and cysteamine which can form mixed disulphides with tissue constituents. The last mechanism is regarded as of special importance as a protective device since when a mixed disulphide is attached by free radicals it will regenerate the target molecule, while on suffering a direct hit, a mixed disulphide provides additional possibilities for the dissipation of radiation energy in a non-deleterious way.

The other reviews are: R. Rugh, General biology: gametes, the developing embryo, and cellular differentiation; C.-J. Clemedson and A. Nelson, General biology: the adult organism; M. Hašek and A. Lengerová, Immunology; and D. W. van Bekkum, Recovery and therapy of the irradiated organism.

1132 HENDERSON, I. F., HENDERSON, W. D. & KENNETH, J. H.
A dictionary of scientific terms.
Oliver & Boyd, Edinburgh and London 1960 : 7th Ed. : 32s. : Pp. xv + 595.

The present edition [cf. XXVIII, p. 172] of this standard biological dictionary appears only three years after its predecessor and forty years after the publication of the first edition. It is remarkable that although the dictionary is reinforced by the addition of 1750 new definitions, bringing the total to around 15,600, the price remains unchanged. The publishers have kept to their judicious policy of resetting the entire volume so that all the additions appear in correct alphabetical order. A number of terms that occur frequently in the literature are, however, conspicuous by their absence. It is fully eight years since Lederberg's pioneer work on transduction but the term has not yet been entered. Recombination, ecocline, topocline and phenodeme are other terms that do not appear. There are, however, no serious criticisms of commission, as opposed to omission, and the volume is highly recommended to all biologists.

1133 CLIFTON, C. E., RAFFEL, S. & STARR, M. P. (Editors).
Annual review of microbiology. Vol. 14.
Annual Reviews, Inc., Palo Alto, California 1959 : $7.50 : Pp. vii + 391 : figs. : tables.

Again [cf. XXX, 2133] the opening contribution is genetical: variation in phytopathogenic fungi, by P. R. Day. The review starts with the subject of physiological specialization, evidence in favour of the gene-for-gene principle being cited. Other topics reviewed are the origin of new biotypes by sexual recombination, heterocaryosis and somatic recombination, cytoplasmic variation and mutation, it being pointed out that some of the new races that have been classed as mutants may be in fact recombinants. The basis of physiological specialization remains very much a mystery.

G. D. Novelli writes on Protein synthesis in microorganisms and R. P. Levine and W. T. Ebersold on The genetics and cytology of *Chlamydomonas*; a review is given of results published in the last few years on life cycles, ultrastructure, chromosome numbers, nuclear cycle, mitotic replication of DNA, mutants, gene recombination and cytoplasmic inheritance. Some of the aberrant segregation ratios observed both spontaneously and after ultraviolet irradiation are thought to result from triple fusion.

C. Yanofsky and P. St. Lawrence write on Gene action; taking as their definition of a gene "a segment of the genetic material carrying the information for the amino acid sequence of a single protein", it is not surprising that they find that "evidence supporting the one gene-one protein hypothesis has increased rapidly in the past ten years." Difficulties of coding and attempts to solve them on the basis of a sequence of 6 amino and 6 keto groups are referred to. Mutations induced by nitrous acid are considered promising for study since it reacts directly with the purine and pyrimidine bases of nucleic acids. Several gene-controlled enzyme systems are discussed. In the section on complementation, reference is made to indications of a correlation between the distance separating mutants and the speed of formation of nutritionally independent heterocaryons, suggesting "exchange within polypeptide chains or within the template material controlling their formation" as a likely mechanism for complementation. A certain amount of evidence for the occurrence of complementation *in vitro* and for the formation of hybrid proteins in higher organisms is adduced. The review ends with some suggestions as to further points on which answers are required. It would have benefited by a little further editing.

Other contributions deal with protein synthesis in microorganisms, fine structure of virus-infected cells and synchronous division in microorganisms.

Heberer, G. & Schwanitz, F.
Hundert Jahre Evolutionsforschung. Das wissenschaftliche Vermächtnis Charles Darwins. (**A hundred years of evolution research. The scientific legacy of Charles Darwin**).
Gustav Fischer Verlag, Stuttgart 1960 : DM 72 : Pp. viii + 458 : figs.

In this memorial volume the various contributors have attempted to assess the influence that Darwin's work has had during the century since the publication of the *Origin of species*, an influence that is said to have extended far beyond the biological sciences alone and to have penetrated such widely separated fields as physics and sociology. Most contributors are unanimous in according Darwin an unique place in having brought to the study of evolution an objective scientific method based on deduction from verifiable facts and in presenting an acceptable mechanism whereby the many improbable phenomena could have conceivably come to pass.

There is a foreword by the editors and the other contributions are as follows.

1134 *Huxley, J. S. Darwin und der Gedanke der Evolution. (Darwin and the idea of evolution). (pp. 1–10).*

The author mentions a large number of points on which later evidence has confirmed Darwin's assumptions or conclusions and Darwin is compared with Newton in the range of significance of his principles. The example of melanism in moths is used to illustrate the operation of natural selection. As regards human evolution, the author expresses the view that quality should now take precedence over quantity.

1135 *Koehler, O. Darwin und wir. (Darwin and ourselves). (pp. 11–31).*

After some biographical details, an impressive list is given of discoveries supporting Darwin's theory that have been made after his death. Several fields of study are named in which little or no progress has been made since Darwin's time and finally it is pointed out that the earth's population is increasing in proportion to available supplies at exactly the rate predicted by Malthus.

1136 *Dobzhansky, T. Die Ursachen der Evolution. (The causes of evolution). (pp. 32–44).*

The role of mutation in providing the material for selection is explained, figures are given showing the genetic load in human and other populations, and cases are cited where a gene that is lethal in the homozygous state may give heterosis when heterozygous. Resistant bacteria and insects are cited as cases of natural selection in operation. It is pointed out however that natural selection adapts an organism to existing conditions, not to the future. Adaptation of future generations of mankind to the conditions in which they are likely to live will require artificial selection.

1137 *Ludwig, W. Die heutige Gestalt der Selektionstheorie. (The present-day position of the selection theory). (pp. 45–80).*

This is a reproduction of a contribution previously printed in another volume [cf. XXV, p. 262–3].

1138 *Dobzhansky, T. Evolution und Umwelt. (Evolution and environment). (pp. 81–98).*

Grounds are cited for the assumption that life could have evolved on other planets than our own. No evidence is found for the operation of autogenesis in evolution and it is pointed out that similar adaptive effects may be achieved by quite different genetic and physiological mechanisms. Natural populations are shown to possess a greater degree of heterozygosity than had been supposed and figures are given showing the wide degree of variation that can arise by recombination between individuals with apparently similar genotypes. The number of possible gene combinations is far greater than the number of individuals comprising even the largest species and hence the genotypic composition of any given population is partly a matter of chance; natural selection of the most viable genotypes in such populations does not therefore lead invariably to the same resultant genotypes, particularly when the original population consisted of a relatively small number of individuals. Experiments made by the author with *Drosophila* populations raised under identical environmental conditions confirm this. Hence, if life has originated on other planets, it is considered improbable that the course of evolution will have been similar to that on our own.

1139 *Brabec, F. Darwins Genetik im Lichte der modernen Vererbungslehre erläutert an botanischen Beispielen.* (*Darwin's genetics in the light of modern laws of inheritance, illustrated by botanical examples*). (*pp. 99–122*).

A full examination, with extensive citations, of Darwin's views on heredity shows how close some of them came to a Mendelian basis while many difficulties and contradictions arose from a lack of understanding of the principles of segregation, of the processes of fertilization and of chimera formation. Darwin's use of statistics and generally critical attitude towards his own results receive high praise.

1140 *Schwanitz, F. Darwin und die Evolution der Kulturpflanzen.* (*Darwin and the evolution of cultivated plants*). (*pp. 122–48*).

The main features distinguishing cultivated species from wild, as recognized by Darwin, are enumerated. Darwin's references to bud sports are cited and the opinion is expressed that many such sports are not the immediate result of mutation but arise from the separation of tissues in a chimera resulting from a mutation that might have occurred some time previously. Darwin is thought to have underestimated the role of hybridization and overestimated that of environmental change; improved cultural conditions either permit the manifestation of potentialities for greater development or enable mutants to survive which in nature would be eliminated. It is further thought probable that selection has been exercised unconsciously for forms possessing genes that increase the mutation rate.

It is again emphasized that in most other respects Darwin's conceptions conform closely with those of modern genetics.

1141 *Klatt, B. Darwin und die Haustierforschung.* (*Darwin and the study of domestic animals*). (*pp. 149–68*).

Covering the same ground for animals, the author emphasizes that Darwin repeatedly stated his view that the inherent properties of organisms were more important than environmental factors in causing variation. Attention is again called to the closeness of many of Darwin's views to modern genetical conceptions in spite of his not knowing Mendel's work. Various contradictions in Darwin's views are however also mentioned.

The significance of parallel variation is thought to have been underestimated by many of Darwin's successors. Little difference can be detected between orthogenesis, now eschewed, and the "trends" of modern geneticists.

1142 *Haustein, E. Darwin als Botaniker.* (*Darwin as botanist*). (*pp. 169–85*).

The light shed by Darwin's studies on questions of plant distribution is reviewed, and his work on cross fertilization, classed as one of the most outstanding discoveries in all biology, and that on plant movements are analysed, with indications of certain cases where Darwin's conclusions have had to be modified.

1143 *Schmidt, H. Darwins Erbe und die Paläontologie.* (*Darwin's legacy and paleontology*). (*pp. 234–76*).

The period immediately following 1859 is described as evolutionist, though criticisms of Darwin's views are also mentioned. There followed a nomographic period, concerned with zoning, and a period of historical paleontology; the points at which some of the main animal and plant phyla are thought to begin are indicated; the origin of both mammals and angiosperms remains, we are told, an unsolved problem. The difficulty of the species question as applied to fossils is discussed; the use of the word "mutation" in modern genetics is stated to be inadmissible since the term had been used already by Darwin, Waagen and others in a different sense. A plea is also made for less dogmatic application of "laws", such as that of irreversibility, that have not been strictly proven. The evidence for explosive periods of evolution is considered unconvincing and no grounds are found for altering Darwin's view that large and small categories have evolved in similar ways. Evolutionists are also warned against assuming that any given organ has no selection value.

1144 *Zimmermann, W. Die Auseinandersetzung mit den Ideen Darwins. (The controversy with Darwin's ideas). (pp. 290–354).*

An analysis is made of the reasons for the horror which Darwin's ideas produced and still produce in certain circles, chief among them being that his evolution principle included mankind, and for their success. The developmental idea was in the air. Early studies of genetics and mutations are thought to have worked against the acceptance of Darwinism, as did many of the political uses to which it was put. The effects of group selection, as opposed to individual selection, were largely overlooked. The divorce between genetics and paleontology and the neglect of phylogenetic study at the present time are deprecated. The writer expresses astonishment at the degree to which Darwin's original conception of evolution has stood the test of time. Much confusion has arisen in both zoology and botany from attempts by Darwin's followers to derive modern taxa from other existing taxa rather than from common ancestors. Most taxonomists are criticized for having largely ignored phylogenetic considerations. The fact that the evolutionary process consists of a large number of interrelated phases and factors, selection being only one, has often been neglected.

No conclusive evidence is found for believing that the additive effect of small mutations is insufficient to explain macroevolution, given a sufficiently long space of time. Neither the fossil record nor experimental material have, it is submitted, provided any evidence of the origin of new forms by macromutation.

1145 *Eibl-Eibesfeldt, I. Darwin und die Ethologie. (Darwin and ethology). (pp. 355–67).*

With the aid of extensive citations from Darwin, his views on the origin of animal behaviour are shown to be supported by later investigations, though his interpretations were more Lamarckian than those accepted today.

1146 *Lenz, F. Die soziologische Bedeutung der Selektion. (The sociological significance of selection). (pp. 368–96).*

Figures are presented showing strong negative correlations between school marks and number of children per family and showing the genetic load in advanced human populations. Any eugenic measures that would be tolerable are considered insufficient to arrest these tendencies. It is pointed out that the survival of the fittest does not imply the survival of the best. Many who have misunderstood and misapplied the Darwinian principles are referred to; they include Nietsche, Hitler, Marx and Lysenko.

1147 *Heberer, G. Darwins Urteil über die abstammungsgeschichtliche Herkunft des Menschen und die heutige paläanthropologische Forschung. (Darwin's opinion on the phylogenetic origin of man and present-day research on paleoanthropology). (pp. 397–418).*

Darwin himself suggested no genealogical tree for man but that drawn up by Haeckel on Darwin's principles is considered to be valid in the light of later data, some of which are reviewed. The writer reiterates the view that the physical and psychical evolution of man, as indeed the whole process of evolution, can be explained on a microevolutionary basis, through the accumulation of small changes, and closes with a suggestion that Darwin's original writings could be reread with profit even today.

1148 HAYES, W. & CLOWES, R. C. (Editors). **Microbial genetics. Tenth Symposium of the Society for General Microbiology held at the Royal Institution, London, April 1960.**
Cambridge University Press, London & New York 1960 : 42s. : Pp. 300 : figs. : plates : tables.

Since the elucidation of the physicochemical structure of DNA the microorganisms have played an increasing part in research into gene structure and hardly any contributor to this symposium [cf. 1157] failed to make some reference to the now famous Watson-Crick model. In an introduction, B. A. D. Stocker spoke on Micro-organisms in genetics, examining some of the basic concepts and explaining some of the terminology. W. Hayes spoke on the bacterial chromosome, presenting the evidence for the existence of bacterial chromosomes, reference being made to the successive transfer of markers along the chromosome and to the need to postulate a single circular chromosome at some stage at least in *Escherichia coli* K12. Results are cited which suggest that the genetic material comprises a single DNA double helix which replicates semiconservatively [cf. XXIX, 124]. In The physical state of the bacterial nucleus, E. Kellenberger gave an account of the more recent techniques and the light they have shed on the fine structure of the bacterial nucleus. Electron microscopy has never revealed a nuclear membrane or more than one chromosome, which seems to be comprised of fibrils "of magnitude of 20 to 60 Å" which are apparently composed of nucleic acids associated with polyamines or basic proteins, replication being semiconservative. A model is presented according to which the fibrils are held together by small protein linkers into a "rope" of about $0{\cdot}2\mu$ diameter, which itself may form a helix of 1–3 turns. Each fibril and each linker are envisaged as reproducing in turn. F. Jacob, P. Schaeffer and E. L. Wollman dealt with Episomic elements in bacteria. The concept of episomes, denoting genetic elements that can exist either as autonomous or as integrated units, is exemplified by temperate bacteriophages and the fertility (F) factor in *E. coli*, it being suggested that when the sex factor becomes integrated the chromosome breaks and is converted from a circular to a linear form. It is further postulated that the sex factor may become temporarily attached to the chromosome and later break away, carrying a small genetic segment with it; the process is referred to as "sex-duction". The third example is provided by the colicinogenic factors and grounds are mentioned for believing that certain other factors, such as those responsible for sporulation in bacilli, may also be controlled by episomes, which, it is suggested, may even be involved in cellular differentiation in higher organisms. R. C. Clowes spoke on Fine genetic structure as revealed by transduction. In a rather inconclusive survey, transduction is explained and data are quoted which show that the sites controlling a series of biochemical steps in bacteria are often closely linked, whereas in higher organisms they are not. Cases are referred to where the amount of DNA transduced is in excess of that contained in one prophage and contains a bacterial fragment and two prophages. In Genetic and functional aspects of galactose metabolism in *Escherichia coli* K-12, E. M. Lederberg refers to groups of galactose-nonfermenting mutants clustered together in a small portion of the genetic map of *E. coli*; a study of 250 mutants by transduction with temperate phage enabled them to be arranged into four cistrons, each determining different enzymatic properties. Certain others not capable of transduction were also identified. "Very few recurrences of previously isolated mutants have been ascertained, none with certainty: almost all of the mutants are easily identified as recombinationally distinct." Preliminary data on linear sequence have been obtained by the time-of-transfer method. Certain transductions have been effected by the fertility factor (F). H. Ephrussi-Taylor, speaking On the biochemical functions of deoxyribonucleic acid, referred to transformation results which suggest that pure DNA incorporated into a bacterial cell is not able to replicate freely in the cytoplasm nor to any appreciable extent in the nucleus before genetic integration takes place. When transformation involves antibiotic resistance, pseudoresistance is conferred during the period before genetic integration of the DNA. Data from recombination support the breakage-reunion model. "From a transforming factor liberated from its dependence upon the bacterium for replication, there is only a step to the origin of viruses, which can be imagined to have arisen when, through some accident, a portion of the bacterial genome in which is situated a region responsible for the synthesis of DNA-activating substances undergoes an extra replication, and becomes detached from the bacterial chromosome." Neoplastic growth, it is suggested, may have a similar origin. R. H. Pritchard, speaking on The bearing of recombination analysis at high resolution on genetic fine structure in *Aspergillus nidulans* and the mechanism of recombination in higher organisms, mentioned data on recombination in *Aspergillus* and bacteriophage that are compatible with the view that recombination takes place at the time of DNA replication and thus favour a copying-choice mechanism rather than breakage and union. The degree of effective pairing may account for differences in different organisms. The patterns of recombination in higher organisms and bacteriophage, though different, are thought to be both reconcilable with a semiconservative type of DNA replication. D. G. Catcheside, in a contribution on Relation of genotype to enzyme content, considered phenomena of complementation and complex loci in *Neurospora* and other organisms. The gene is now defined as "the segment of hereditary material which specifies one integral function". This is usually "an aggregate of similar polypeptides forming a protein with one catalytic function at one active site". For many organisms a number of sites within certain genes have been discovered and mapped, in some cases linear order being established, in others not; hence it is suggested that "the actual physiological properties, including complementation, are dependent upon the precise site in the gene at which mutation has occurred and also upon the particular change which has occurred at this site". Information on the genetic control of a number of enzymes is reviewed. Some mutants that fail to produce a given enzyme form a material that cross reacts with it, whereas others do not; in certain cases various other altered types of behaviour have been observed; some show complementation in heterocaryons, some do not, and occasionally complementation has been demonstrated *in vitro*. A strong relationship between genes and enzymes has been established but "there is still a considerable gap between the gene which has not as yet been defined chemically and the enzyme whose chemistry is known only by its finger prints". G. L. Brown, speaking on DNA and specific protein synthesis, examined various versions of the template hypothesis and recent findings on the composition and structure of DNA; several lines of evidence are cited to show that differences exist between the DNA from different bacterial species and that DNA molecules prepared by modern methods "contain information for more than one cistron". Attention is called to the existence of certain special bases as constituents of DNA in some species, such as 5-hydroxymethylcytosine in T-even bacteriophages and 6-methylaminopurine in *E. coli*, and to the possibility of incorporating analogues in place of the normal bases; certain substitutions have resulted in a rise in the mutation rate, some of the mutants being different from those arising naturally. The possibility that the aminoacid coding sequences may be species-specific is discussed and many a reader may welcome the remark "it seems that theoretical analysis of the coding problem has reached its limits, and that experimental evidence is required to give firmer support to the sequence hypothesis". Methods are described for preparing a homogeneous soluble RNA from *E. coli* and for separating it into fractions that react specifically with different aminoacids. When protoplast ghosts of *E. coli* were incubated with aminoacids in the presence of bacteriophage DNA, phage-related proteins were formed. A. Garen dealt with Genetic control of the specificity of the bacterial enzyme, alkaline phosphatase. He mentioned experiments which show that all the mutants of *E. coli* lacking phosphatase found so far fall into a narrow region comprising 0·01% of the total map of the chromosome. Several of the mutants involved were "leaky" or showed other anomalies of behaviour. Many revertants having enzymatic activity equal to the wild strain were found, together with one producing an enzyme with slightly altered properties. Some of the mutants produced a protein that was closely related to the enzyme immunologically and chemically. In Ribonucleic acid as genetic material of viruses, A. Gierer mentioned that all the small viruses investigated have been found to contain a constant amount of RNA, equivalent to some 6000 nucleotides, which is considered to correspond to a single molecule; evidence is presented for believing it to constitute a single strand, which may be coiled or folded, that it is infective in the absence of protein and that any cleavage of the molecular strand destroys the infectivity. Deamination of certain nucleotides by nitrous acid causes inactivation while leaving the strand intact, and deamination of others causes mutation; the kinetics of the mutagenic effect shows that single deaminations can be mutagenic. The demonstration of free infective RNA in cells infected with virus is taken as proof that the infective RNA is produced before the virus particle is assembled. A. Maaløe spoke on The nucleic acids and the control of bacterial growth. The repression of the formation of an enzyme by a high concentration of its product is shown to be a highly complex process and is considered to be an important factor in the economy of bacterial growth. Data are cited showing the rate of protein synthesis to be proportional to the number of RNA particles per nucleus. When growth conditions are improved, synthesis of RNA and ribosome protein increases before the increase in DNA, general protein and cell division. "It is therefore difficult to accept any scheme which demands that the synthesis of an enzyme molecule and the formation of a new unit of RNA (a template) go hand in hand. As stated above we prefer to think that new RNA is made by copying directly from DNA. It is possible that the ribosome protein serves a special purpose in this process of replication, afterwards appearing as the structural element of the particle". The last contribution was by J. F. Danielli, on Inheritance in amoebae, studied by nuclear transfer. Studies of heterotransfer clones, containing a nucleus of one origin and cytoplasm of another, have shown that the nuclear diameter and shape are affected by the cytoplasm as well as the nucleus, as are such properties as streptomycin resistance, and reaction to a foreign nucleus or cytoplasm. The nucleus alone seems to be responsible for the capacity to synthesize a particular antigen, the composition of the aminoacids and the capacity to become resistant to antiserum. The view is put forward that "whereas the nucleus controls the possibility of particular chemical substances appearing in cells, the cytoplasm on the other hand controls the way in which macromolecules are organized into functional units".

1149 Picken, L. E. R.
The organization of cells and other organisms.
Clarendon Press : Oxford University Press 1960 : 84s. : Pp. xxxvii + 629 : 113 figs. : 34 plates.

The practising scientist, especially at the beginning of his research career, is often concerned almost exclusively with his immediate problems of techniques and practical results, regards books more than a few years old as out of date and therefore more or less useless, and consequently spends the little reading time he allots himself mainly on current publications which will keep him up to date with advances in his own field. Whether such a procedure is the result of pressure of work and competition, or of the natural inclination of the mind with a largely practical bent may be uncertain, but there can be little doubt that it has a narrowing tendency. The disadvantage of being unable to see current work and concepts in relation either to other branches of the same study or to past work, is forcibly stated by Dr. Picken in his introduction to the volume under review. His aim is "to attempt a synthetic picture of the organization of cells in terms of macromolecular structure and texture," to present material from the related fields of virology, bacteriology and immunology which he considers should now belong to the general background knowledge of the cytologist, and to integrate this whole field and see it in relation to the past.

The scope of the book is thus wide, but since it is addressed not to the undergraduate but to the postgraduate or research student, a basic knowledge of cytology can be assumed and thus allows the more advanced subject matter to be discussed in some detail. The first chapter has the same title as the whole book, and is concerned with the history of the cell concept, the extent to which viruses may be regarded as organisms, the relationship between structure and function, and a discussion of some types of organisms; viruses, bacterial cells (protocells) and the cells of Protozoa, Metazoa and Metaphyta (eucells) are all regarded as organisms.

There follow two chapters on the Organization of viruses and the Organization of certain schizomycetes. The organization of eucells is considered in five chapters dealing respectively with the nucleus, bulk properties of cytoplasm, cytoplasmic particulates and membrane-systems, fibrillar cytoplasmic structure, and the cell surface and cell membranes. The two final chapters are entitled Extracellular materials and structures and their role in the spatial extension of cellular activities and Becoming multicellular as seen in the light of cell properties.

"This book is a compilation," says Dr. Picken in his preface. This is too modest a claim. It is true that he has drawn extensively on numerous reviews and original papers. The bibliography itself, although an attempt has been made to limit it wherever possible, while leaving enough references to indicate sources and to allow the reader to find his way into the relevant literature, covers nearly 77 pages. But very much more than the mere collecting together of material has gone into the making of this book. Dr. Picken's continual awareness of the effects of habits of thought upon scientific concepts, and of the relevance of early to present work, together with the clarity and firmness of his style, give his "compilation" a unity which could all too easily be lacking from a survey of this kind. All who work in any of the various fields concerned with macromolecular organization of cells—and other organisms—will find this a valuable book.

The volume is handsomely produced, contains numerous photographic illustrations and text figures and is provided with a detailed index. The reviewer's only complaint is that the publishers have seen fit to print it on such thick, heavy paper that the 600-odd pages make a tome more than two inches thick, too weighty and unwieldy to handle with comfort.

1150 Rudnick, D. (Editor).
Developing cell systems and their control.
The Ronald Press Company, New York 1960 : $8.00 : Pp. vi + 240 : figs. : tables.

The eighteenth symposium in this series [cf. XXX, 942] was devoted to advances in the knowledge of cell differentiation and its control within the organism. Again a wide field was covered. J. T. Bonner spoke on Development in the cellular slime molds: the role of cell division, cell size, and cell number. It was decided to reexamine the possible role in development of cell division, cell size and cell number. A generation time of just under 3 hr. has been established, the time taken by mitosis varying from 7·1 to 9·9 minutes. Differentiation was found to be not dependent on cell division. Aggregation was not favoured by cell density and seems to depend largely on a time factor; there was no evidence of sexual fusion.

There followed contributions on regeneration in hydroids, tissue reconstruction from dissociated cells, gibberellins and plant growth, hormonal control of growth and regeneration of body parts in vertebrates. H. Stern then spoke on Biochemical sequences in mitosis; studies on developing anthers of *Lilium longiflorum* have shown a rise in the sulphydryl concentration just before prophase and the presence during interphase of an –SH protein which seems to be used, "for purposes not yet identified", at mitosis. A marked accumulation of deoxyribosidic material was found to precede chromosome duplication at mitosis and meiosis. "Contrary to some old views of thiol compounds as causal mitotic agents, the evidence suggests an activation at the time of mitosis of thiol-requiring systems, which draw upon the available store of thiols".

A. B. Novikoff spoke on Biochemical and staining reactions of cytoplasmic constituents. Modern ideas on the structure of the cytoplasm are compared with those current at the beginning of the century. The supreme achievement of differential centrifugation has been, we are told, "to establish the mitochondria as the chief, and probably exclusive, sites of oxidative phosphorylation". The merits and defects of staining methods are discussed and evidence is presented for believing that most of the microbodies described by electron microscopists are lysosomes, "cytoplasmic organelles delimited by 'single' outer membranes and possessing high levels of acid phosphatase and, presumably, other hydrolases with acid pH optima".

The last contribution is by T. S. Work on Protein biosynthesis: some connecting links between genetics and biochemistry. A number of instances are cited where two enzymes of differing specificity are all but identical in aminoacid sequence, the small differences detected being assumed to have arisen by mutation. Corresponding enzymes from different species differ in much the same way but to a greater degree than those from different individuals within a species. The macromolecules of DNA are copied by a process of linear organization, which can occur in the absence of protein, whereas RNA is apparently not self reproducing; it is suggested that "the sequence of purine and pyrimidine bases in RNA is determined by polymerization of RNA on a DNA surface or more probably, since viral RNA is a copy of itself rather than a copy of some cellular structure, on a surface composed of a doublet in which a molecule of RNA is firmly attached to a molecule of DNA". Though protein synthesis occurs most rapidly in the microsomes it can apparently take place in all particulate cell fractions. Much knowledge has accumulated recently on the mechanism of synthesis and it is thought that before long it may be possible to add DNA or RNA to an enzyme preparation and follow the synthesis of a specific protein.

1151 STEWARD, F. C. (Editor).
Plant physiology. A treatise. Volume 1B. Photosynthesis and chemosynthesis.
Academic Press, New York and London
1960 : $12.00 : Pp. xvii + 348 : figs. : tables.

Volume 1B [cf. XXX, 4526] comprises two chapters only, one devoted to energy storage, and the other to the energy relations of chemoautotrophic organisms. The former, after some introductory historical sections, proceeds to an analysis of what is known today about the nature and mechanism of the unique process whereby as much as one-third of the energy available in the light absorbed is collected and retained. This includes some of the most recent information on the structure of the chloroplast as provided by the electron microscope. Not all these structures are necessary for photosynthesis and astonishment is expressed at "the persistent capacity to evolve oxygen, i.e., to accomplish the photolysis of water, in extracted chloroplast fractions, even after they have been dried, extracted with organic solvent, and reimmersed in water." However, mutants defective in photosynthesis are found to have defective chloroplast structure.

Some popular misconceptions, such as the belief that red light is necessary for photosynthesis, are corrected and, after a full analysis of the data, several other obsolete or useless hypotheses are examined. A rather impressive list of unsolved problems is given, one of them being whether the chlorophyll molecule itself undergoes chemical changes or is merely a sensitizer. The complete artificial reconstruction of photosynthesis in the test tube is seen as a goal for the laboratory scientist rather than as a substitute for agriculture. This chapter is provided with a bibliography of 624 titles.

The second chapter provides some interesting comparisons between the processes of photosynthesis and those occurring in organisms that derive all their energy from the oxidation of inorganic compounds. We read that the ability to reduce sulphate and nitrate is present in most microorganisms and higher plants but absent in higher animals and the evidence on possible mechanisms for the sulphate reduction is outlined; nitrate reduction will be dealt with in Volume III. Under chemosynthesis the nitrifying bacteria, sulphur bacteria and hydrogen bacteria and the reduction of carbon dioxide by chemosynthetic bacteria are considered.

1152 Meyer, B. S., Anderson, D. B. & Böhning, R. H.
Introduction to plant physiology.
D. Van Nostrand Co., Inc., Princeton, New Jersey 1960 : 56s. : Pp. v + 541 : figs. : tables.

Repeated requests have prompted the writing of this shorter and more condensed version of *Plant physiology* by the first two authors, B. S. Meyer and D. B. Anderson, which appeared in 1940 and has since been a leading textbook in the USA [cf. X, p. 318]. In general outline and approach, the new book closely resembles the parent volume, but information on recent advances in various fields has been incorporated and many sections have been rewritten. The third author, R. H. Böhning, Associate Professor of Botany, Ohio State University, has shouldered a large share of the responsibility for the preparation of the shorter version. The reduction in length has been achieved by compressing the coverage of certain topics which were considered to be peripheral in relevance, by cutting down on the number of illustrative examples and by eliminating all discussion of techniques of measuring physiological processes.

1153 Luck, J. M., Allen, F. W. & MacKinney, G. (Editors).
Annual review of biochemistry.
Annual Reviews, Inc., Palo Alto, California 1960 : **29** : $7.50 : Pp. vii + 786 : figs. : tables.

The volume [cf. XXX, 944] again starts with a prefatory chapter, largely comprised of reminiscences, by H. O. L. Fischer. There is a contribution on The biochemistry of genetic factors by R. L. Sinsheimer, who refers to demonstration in at least one bacteriophage of single-strand DNA capable of genetic recombination. Reference is also made to indications that on replication, old DNA double helices are wholly conserved, while new DNA double helices are completely new and that the entire question of the mode of DNA replication must be re-examined. Further evidence that the bacteriophage chromosome consists exclusively of nucleic acid is mentioned. Difficulties for the coding concept arise from the demonstration of wide differences in nucleotide composition of DNA from different bacterial species and of its relative constancy in their RNA and the manner of synthesis of RNA is, we are told, still an enigma. Enzyme changes that occur after infection of a bacterium by phage are ascribed to "information provided by the infecting DNA". In interpreting the mutational effects of ultraviolet radiation, a critical experiment is called for "to distinguish between the alternative possibilities that the primary injury is to the DNA or to the cytoplasmic components". Attention is called to the importance of the concept of the genetic control of protein structure as put forward by Crawford and Yanofsky [XXX, 34–5]. No reason is found for doubting that nitrous acid can produce mutants in infective RNA. Recombination has been reported in mixed infection with certain animal viruses but not with plant viruses. In the formation of turnip yellow mosaic virus the protein shell is apparently made first and the RNA is inserted in several discrete stages.

G. N. Cohen and F. Gros write on Protein biosynthesis. Grounds are reported for believing that the cell contains a population of soluble RNA molecules, each specific for a given amino-acid, though whether a given RNA molecule has the same structure in different species has not yet been decided unequivocally. Many results point to a protein-synthesizing capacity in the RNA fraction of the microsomes but others conflict with this view. At least one gene is referred to which not only contains structural information for a given enzyme but "the totality of this information". Changes in the properties of enzymes by other than genetic means and by the cytoplasm are also reported.

In Biochemistry of viruses, L. M. Kozloff points out that though infectious RNA has now been isolated from several viruses, this has not been done for DNA, which may indicate important structural differences between them; other results pointing to the same conclusion are reviewed. However, "the important question of the presence and possible role of viral protein in the preparations of infectious RNA still remains unanswered". As regards bacteriophage T2, we are told that only a beginning has been made in separating and characterizing its main constituents but calculations of molecular weight are compatible with the idea that the DNA may exist as a single particle. In the smallest of the known bacteriophages the DNA appears to be a single-stranded structure rather than a double-stranded helix. Several results suggest that RNA serves as an intermediate between DNA and protein synthesis.

Other contributions in this issue include Nucleic acids—selected topics related to their enzymology and chemistry, by C. A. Dekker, The structure of proteins, by G. E. Perlmann and R. Diringer, and Metabolism of amino acids, by S. Udenfriend, H. Weissbach and C. Mitoma.

1154 SINNOTT, E. W.
Plant morphogenesis.
McGraw-Hill Book Company, Inc., New York, Toronto, London 1960 : $12.50 : Pp. x + 550 : figs.

Professor Sinnott combines the distinction of being one of the foremost of the dwindling race of pure morphologists and a pioneer in the genetics of shape, many papers of his on the inheritance of fruit shape in cucurbits having been noticed in earlier volumes of *Plant Breeding Abstracts*.

While plant morphology as commonly expounded tends to treat plant structures as a "slice of space", the morphogeneticist advances to the conception of a "slice of space-time". The first half of Professor Sinnott's work is a detailed and well-documented survey of the basic concepts of morphogenesis, these being considered under the headings: growth in general, the cellular basis of growth, meristems, correlation, polarity, symmetry, which is extended to cover spirality, differentiation, regeneration, tissue mixtures and abnormal growth, including galls and tumours.

The second half of the book deals with causal morphogenesis and here we have what the cyberneticists would call a black-box problem: one knows what experimental treatments are applied and what morphogenetic responses these give rise to, but the mechanism of the causal chain is, in most cases, quite obscure. The causal factors considered are light and photoperiod, water, temperature, thermoperiod and vernalization, mechanical stimuli, and chemical factors, including growth substances. An important chapter on the internal causal factors constituted by the genotype follows, which draws largely on the author's own researches on the genetics of fruit shape. Among the genetic aspects considered are the morphogenetic effects of gene dose, polysomaty and aneuploidy.

More than once, the author emphasizes that the recent advances made in elucidating the mode of action of the nucleic acids in plant cells have not, as yet, contributed much towards an understanding of how plant organization and equifinality are maintained. He suspects, in fact, that biophysics rather than biochemistry may provide the necessary clues.

Occasionally, as in the discussion on p. 24 as to what an "individual" is and on p. 287 where gall-forming capacity is described as "new historically but not morphologically", one feels that the author is wrestling with words rather than ideas but in general his grasp on the often intricate and obscure conceptual framework of morphogenesis is assured and his exposition clear. A critic might aver that the book lacks any fundamental unifying concepts and is only a rag bag of miscellaneous observations. This, however, is only as it should be in the light of present knowledge. Only the growth-substance workers and perhaps a few geneticists have as yet managed to peep into the black box and until one knows what is inside the only method of unifying the subject would be by recourse to the procedures of idealist morphology, from which the author has worthily abstained.

There are a few misprints: *Eriophyes* is consistently misspelled as *Eriophyces*.

1155 **Supplement to the catalogue of Lewis's medical, scientific and technical lending library, supplement 1957–1959.**
H. K. Lewis & Co. Ltd., London 1960 : subscribers 5s. : non-subscribers 10s. 6d. : Pp. 306.

A further supplement has now been issued. Information on the scope of this catalogue and library may be found in previous references to the publication [cf. XV, p. 372; XVII, p. 493; XXI, p. 712; XXIII, p. 654].

1156 KURTH, H.
Chemische Unkrautbekämpfung.
(Chemical weed control).
Gustav Fischer Verlag, Jena 1960 : DM 22 : Pp. ix + 229 : 71 figs. : 27 tables.

The volume starts with some statistics of the losses to agriculture occasioned by weeds and of the seed-forming propensities of some of the main weed species. The different types of weeds and the damage they cause are classified and the conventional methods of weed control are outlined. The main types of selective herbicides are then characterized, with explanations of their composition and mode of action, the species for which each is effective and possible dangers that attend their use, together with some excellent illustrations showing their effect. Similar information is given for non-selective herbicides, after which comes a series of chapters in which the crop plants are considered in groups and indications are given of the treatments found most effective in controlling their weeds. There is also an alphabetical list of weed species showing the best herbicides for use in their control. A final chapter deals with equipment for herbicidal treatment and an appendix provides tabular information on all the above topics in classified form.

There is an extensive bibliography which, however, covers titles only up to 1957, with a few for 1958.

1157 ISAACS, A. & LACEY, B. W. (Editors).
Virus growth and variation. Ninth Symposium of the Society for General Microbiology held at the Senate House, University of London, April 1959.
Cambridge University Press, London & New York 1959 : 35s. : Pp. 272 : figs. : plates.

The ninth symposium [cf. XXVIII, 3571], the second devoted to virus research, served to emphasize "the narrowness of the gap which now separates the strictly biological and strictly biochemical approaches to virus research", viral nucleic acid emerging as the dominant theme. In Viruses: a survey of some current problems, S. E. Luria mentions some outstanding recent advances, all pointing to DNA as the essential genetic constituent, and suggests some probable lines of further development. The units of mutation, recombination and genetic function (muton, recon, cistron) having been defined, RNA genetics is foreseen as a thing of the future. Viruses are defined as "elements of cellular genetic material that can determine, in the cells where they multiply, the biosynthesis of a specific apparatus for their own transfer to other cells". We may, it is thought, be able "to interpret some of the effects of viruses on their hosts as infective heredity rather than as parasitism". In Growth of bacteriophage, E. Kellenberger refers to further evidence strengthening the hypothesis that DNA is the sole carrier of genetic information. In the even-numbered T phages of *Escherichia coli* the cytosine of the phage DNA is replaced by 5-hydroxymethylcytosine and can thus be studied independently of the bacterial DNA; the amount of glucose attached varies with the strain. The genetic pool, postulated theoretically, has been identified with fine fibrils demonstrated in the electron microscope. Protein synthesis seems to be a prerequisite for the synthesis of phage DNA and for its condensation into phage; defective prophages are found which are able to serve as a template for DNA but apparently lack some information for building up the copy. Different degrees of genetic parasitism are considered, that of the T-even phages being referred to as "totalitarian"; results from studies with them are not necessarily applicable to other organisms. "The hypothesis that protein synthesis goes obligatorily through RNA is in agreement with the different observations, but cannot yet be regarded as more than tentative". B. D. Harrison spoke on The multiplication of viruses in plants, pointing to a number of basic similarities between plant and animal viruses and phages. It is largely assumed that the nucleic acid separates from the protein at infection, as in bacteriophages, though much of the evidence is circumstantial; this evidence is reviewed, possible alternative interpretations being considered. Strains of tobacco mosaic virus apparently differ in the strength of the linkage of the nucleic acid to the protein and possible roles of the protein moiety in infection are discussed. Different viruses seem to have different attachment sites in the cell. The actual sites of virus multiplication in the cells are still unknown, though the microsomes seem to be implicated; however, "there seems nothing inherently unlikely in the possibility that the nucleic acid and protein parts of virus are formed in different parts of the cell". Variant strains that arise when a virus is propagated in new hosts or under changed environment are referred to, though it is "an open question whether the production of the variants is directed by the new host or whether the new host merely applies a strong selection pressure to variants produced by chance". A few cases that suggest recombination in mixed inoculation are referred to rather cautiously.

There follows a series of contributions on various animal viruses, one of which is Fluorescence microscopy: observation of virus growth with aminoacridines, by E. S. Anderson, J. A. Armstrong, and J. S. F. Niven; the varied effects of acridine orange and related dyes described all depend on their differential affinity for the two nucleic acids. In studies with various strains of *Salmonella typhi* and *E. coli*, here reported, the nuclei showed the greenish fluorescence of DNA and the cytoplasm the red fluorescence of RNA. The changes occurring in lysogenic cells after ultraviolet irradiation were followed and are described. The DNA content gradually increased and the RNA decreased. A similar increase of DNA was observed in cells of *E. coli* infected with phage T2 and was accompanied by a disappearance of the nucleus.

When the cells burst the DNA was visible in granular form outside the cell. Similar studies on a range of animal viruses are reported.

1158 ROEMER, T. & RUDORF, W. (Editors). Handbuch der Pflanzenzüchtung. (**Manual of plant breeding**).
Paul Parey, Berlin & Hamburg 1960 : 2nd Ed. : Lief. 37 : Vol. 6 : Bogen 16–20 : 241–320; Lief. 38 : Vol. 6 : Bogen 21–25 : 321–400; Lief. 39 : Vol. 5 : Bogen 11–15 : 161–240; Lief. 40 : Vol. 5 : Bogen 16–20 : 241–320; Lief. 41 : Vol. 5 : Bogen 21–25 : 321–400 : figs. : tables : DM 13.50 each.

Instalment 37 [cf. XXX, 3376] completes the section on spinach in volume 6, inheritance of sex and special methods used in testing for resistance to cold and disease, for quality and for yield being outlined. Breeding methods are described and some of the achievements of breeding recalled. These include the production of cultivars suitable for forcing and possessed of resistance to frost or various diseases. The hybrid varieties so far produced are not considered fully satisfactory and various other directions in which improvements are desirable are named. Next comes Salat, *Lactuca sativa* L. [Lettuce, *L. sativa* L.], by A. H. Bremer. The question of the origin of the species and of its relationship to *L. scariola* is regarded as undecided. The main types of cultivated lettuce and their floral biology are described and information is given on the inheritance of a number of morphological and economic characters and on breeding methods and achievements. They include a winter-hardy day-neutral lettuce, and cultivars resistant to several races of *Bremia lactucae*, *Botrytis cinerea* and other fungus diseases and to mosaic virus. The next section is Küchenzwiebel, *Allium cepa* L. [Onion, *A. cepa* L.], by H. Kuckuck and G. Kobabe. Information is given on the cultivated species of *Allium* and their genetical and cytological interrelationships, *A. cepa* being erroneously referred to on p. 271 as a genus. Floral biology, vegetative reproduction and technique of hybridization are dealt with and separate sections are devoted to the inheritance of economically important characters and to breeding methods; these include crossing between species of various degrees of relationship. Cultivars distinguished by greater earliness, uniformity, yield, keeping capacity and disease resistance and the production of hybrid varieties are mentioned under the achievements of selection.

The first part of the section Frucht- und Samengemüse [Fruit and seed vegetables] begins with Gurken [Cucumbers], by J. M. Andeweg. Biology of flowering and crossing technique are dealt with in this instalment and the inheritance of characters is started, being completed in instalment 38, which continues with breeding methods and is completed by some remarks on tetraploids obtained by colchicine treatment; they are slower in growth and mature later but are somewhat more tolerant of low humidity. Attempts to produce triploids have not been successful. The next contribution is Breeding squash and pumpkins, by T. W. Whitaker; the species are surveyed and data cited for believing the genus *Cucurbita* to have originated exclusively in America, *C. lundelliana* having played a conspicuous role in the evolution of the cultivated species. Various interspecific crosses are described, and details are given on floral biology and breeding methods, a number of instances of heterosis being cited. An outline is given of those characters whose inheritance has been studied; the main results of breeding mentioned are confined to those in the USA. Tomato breeding is dealt with by T. M. Currence. In discussing the species of *Lycopersicon* and their origin, the view is taken that the tomato was taken into cultivation in Mexico, the probable ancestor being the cherry tomato. Modes of pollination and of crossing are outlined and data, some in tabular form, are given on the inheritance of characters. The main diseases of the tomato are described, some of the resistant varieties produced by breeding being mentioned, with details of their origin; several are derived from interspecific crosses. Under breeding methods, special attention is given to heterosis, data being cited showing improvements in yields, earliness and other qualities from the use of both F_1 and F_2 seed. An outline is given of a proposed system of hybrid production with the use of male sterility, selfing being performed in alternate back-cross generations. Examples of breeding achievements and the literature cited are again confined to the USA. The next contribution is Bohnen (*Phaseolus vulgaris* L., *Phaseolus coccineus* L.) [Beans (*Ph. vulgaris* L., *Ph. coccineus* L.)] by E. Kooistra. In discussing the specific interrelationships, the origin of the garden beans is ascribed to a series of recessive mutations from a wild form of the type of *Ph. aborigineus* [cf. XXIII, 3097]. Information is given on cytology, floral biology, photoperiodism, pollination and the inheritance of characters. The properties required by the breeder are analysed and the main diseases are described, with indications of resistant varieties and the inheritance of resistance when it is known. Breeding methods are also discussed.

Instalment 39 completes the section on tobacco in volume 5, the topics examined being special problems of tobacco breeding in Europe and breeding methods, many examples being cited of the use of heterosis and transgression in breeding both *Nicotiana tabacum* and *N. rustica*; by appropriate selection it has been possible to fix the transgressive forms and so maintain the hybrid vigour in a pure-breeding state, some of the selections having exceeded even the F_1 hybrids in vigour. Some of the most promising parental combinations are indicated. Examples are cited of the use of interspecific crosses, particularly in breeding for disease resistance, and of induced mutations. Results of vegetative hybridization published in the Soviet Union are, it is pointed out, difficult to assess owing to the absence of data on the genetical constitution of the parents. Methods employed in testing breeding material and varieties for resistance to diseases and other unfavourable factors, for various features affecting quality and for a number of other properties are outlined. The chief research stations in Europe where tobacco breeding is carried out are listed. The next chapter is Hanf, *Cannabis sativa* L. [Hemp, *C. sativa* L.] by W. Hoffmann. After an outline of the botanical characteristics and the origin of the species, ascribed to Central Asia, data are given concerning chromosome constitution, polyploidy, biology of flowering and the inheritance of characters. Various mutants, natural and artificial, are mentioned and the breeding methods are described, with special consideration of the modifications necessitated by the diecious nature of the plant. Details are given of methods of determining yield, fibre content and fibre quality. This section is continued in instalment 40, which gives information on sex types and their inheritance and on the breeding of monecious hemps and types with simultaneous ripening; also on breeding for resistance to various diseases and pests. Some of the best-known cultivars are described. The instalment continues with the first part of Lein, *Linum usitatissimum* L. [Flax, *L. usitatissimum* L.] by W. Hoffmann. The views of various authors on the systematics of the species and the origin of cultivated flax are considered, and information is given on cytology, biology of flowering, genetics and breeding methods. This section is completed in instalment 41, where consideration is given to resistance to the main diseases and the most important cultivars in different countries of the world. The instalment continues with Hop improvement, by K. R. Keller, who deals with systematics and cytology, biology of flowering, germination, breeding methods, the inheritance of characters, disease resistance, quality and experimental tests. The instalment continues with the first part of Arzneipflanzen [Medicinal plants], by E. Schratz. Starting with some details concerning the cultivation of medicinal plants in Germany, the most important of which are *Digitalis* and *Valeriana*, the writer examines the special problems of breeding medicinal plants; considerations of quality are of prime importance and the various factors that can influence the content of an alkaloid or other component in a given plant or organ are analysed.

1159 PARODI, L. R.
Enciclopedia argentina de agricultura y jardinería. I. Descripción de las plantas cultivadas. (**Argentine encyclopedia of agriculture and horticulture. I. Description of the plants cultivated**).
Editorial Acme S.A.C.I., Buenos Aires 1959 : $28.50 : Pp. xv + 931 : 252 figs. : 1 plate.

The first volume of the encyclopedia contains descriptions of over 2700 species of plants cultivated in the Argentine Republic, some 600 of them being illustrated by line drawings. The volume begins with an explanation of the basic principles of botanical taxonomy, in which unfortunately the use of the cultivar is explained incorrectly [cf. XXVIII, 2425]. The plants are arranged according to families, based on Engler-Gilg (1936), and a key for their identification precedes the descriptions. There are also keys for the determination of the genera within each family and the species within each genus; where botanical varieties exist within the species they are also described. Indications are given of the common Spanish and local names where such exist and there is an index in which both Latin and Spanish names are listed alphabetically. There is also a glossary of some, though not all, the botanical words employed, and a selected bibliography.

1160 BÄRNER, J.
Bibliographie der Pflanzenschutzliteratur 1953. (**Bibliography of plant protection 1953**).
Biologische Bundesanstalt für Land- und Forstwirtschaft, Berlin-Dahlem 1960 : Pp. 527.

The bibliography has been compiled in the same way as its predecessors [cf. XXX, 952]. It includes a general section for collective works, text books and reports of activity and congresses, two sections in which the literature is classified according to the cause of disease and the host plant respectively and a fourth section concerned with measures of plant protection. An author index completes the work.

1161 **Progressive wheat production.**
Centre d'Étude de l'Azote, Geneva 1960 :
Pp. 338 : figs. : tables : plates.

The Centre d'Étude de l'Azote, founded in 1953 by nitrogen producers of a number of European countries, has already produced three volumes on tropical crops in this series on soil fertility and manurial problems. The present number in the series, the first on a temperate crop, differs from its predecessors in being less exclusively concerned with crop production and fertilizer application and thus in being of greater general interest.

The book is divided into two parts. The first, which contains several articles on various aspects of wheat production, begins with a survey by F. C. Schlömer of some social and economic problems of demand, supply and world trade in wheat. Dr. F. Wienhues contributes a chapter on Botany and breeding of wheat, in which an outline of the main morphological and developmental features of wheat is followed by a consideration of systematics and the methods and objectives of breeding. The subjects of the last two chapters in the first part, Die Kultur des Weizens [The cultivation of wheat] by Professor L. M. Kopetz and Les bases physiologiques de la nutrition et de la fertilisation rationelle du blé [The physiological bases of the nutrition and rational fertilizing of wheat] by Y. Coïc, are indicated by their titles; both consider the use of nitrogen fertilizers in some detail and both are concerned mainly with conditions in western Europe. English summaries of these two chapters are provided.

In the second part, comprising nearly two-thirds of the volume, details of acreage, yields, main varieties grown, cultural practices, use of fertilizers, the chief pests and diseases and the main research institutes are given for each of the main producing countries.

This is not an advanced treatise, and the specialist looking for a summary of recent advances in his own branch of study will be disappointed. But by its attractive presentation (the design and lay-out and the photographic reproductions are of the high standard we have learnt to expect from the Netherlands, where the book was printed and produced), this comprehensive survey will commend itself to the general student requiring readily assimilable information on wheat and wheat production, and it should also prove useful to the specialist who desires to obtain a working knowledge of fields other than his own.

1162 TURNER, B. L.
The legumes of Texas.
University of Texas Press, Austin 1960 :
$6.00 : Pp. 284 : 1 fig. : 1 table : 178 maps.

There were good reasons for the preparation of this book, the scope of which is shown by its title; much of the new information presented will be invaluable in future academic and applied studies. Each of the 391 taxa of leguminous plants found in the five major floristic regions represented in Texas is described, together with its distribution in the state, and some ecological and, where appropriate, agricultural data.

The Leguminosae, treated as one family of flowering plants, are divided into three subfamilies for each of which the characters of the genera and their species are systematically described. The excellent dichotomous keys, constructed by the author, for generic and specific identifications are based on vegetative, floral, and where necessary, fruit characters. Dot maps showing species distribution have been compiled but they are not always clear, especially when two or three species are recorded on one map. Where known, chromosome numbers are listed, those for 43 species, counted by the author and his colleagues, being published for the first time. This book has been compiled meticulously and logically. Dr. Turner carefully lists the criteria used for specific and varietal distinction; he includes synonyms from previous major works and suggests alterations in nomenclature only after detailed revisionary study of groups, unless previous names are contrary to the International Code of Botanical Nomenclature. This stimulating book, in which the one illustration is, appropriately, the official state flower of Texas, *Lupinus subcarnosus*, contains over 100 references covering a wide range of scientific study.

1163 HANELT, P.
Die Lupinen. **(Lupins).**
Die neue Brehm-Bücherei, A. Ziemsen Verlag, Wittenberg Lutherstadt 1960 :
Pp. 104 : 37 figs. : 6 tables.

Starting with an account of the taxonomy of the genus *Lupinus* and the geographical distribution of the species, this popular booklet then gives full descriptions of the most important species for agriculture, beginning with *L. albus*. In addition to the botanical descriptions, details are given on phasic development in forms of different geographical origin, on the forms considered most promising for breeding purposes and on the history of cultivation, with citations from classical and medieval authors. The first introduction of lupin cultivation in Germany, its later vicissitudes and the production of the first cultivars are described. The first sweet forms of *L. albus* were isolated in 1935 and cultivars suitable for growing in central and southern Germany are now available; one of these, Hadmerslebener Neutra, bred at Hadmersleben in the German Democratic Republic (DDR), possesses the advantage of a neutral reaction to temperature in the early growth stages. Reference is also made to some of the cultivars produced in Federal Germany, the most recent of which is Blanca. It remains however uncertain whether the white sweet lupin in Germany will be able to compete with the other species; some data are given on the extent of its cultivation in other countries.

Next to be described are *L. luteus* and *L. angustifolius*; both species seem to have their centres of origin in the Mediterranean region and reference is made to a related Mediterranean species, *L. linifolius*, which has been used in crossing with *L. angustifolius*. The changes that have been effected in both species in the course of cultivation are outlined, the production of the first cultivars is described and the now familiar story of the production of sweet lupins is recounted [cf. XXX, 4545]; an account is given of the breeding work that is being carried out at the present time with yellow and blue lupins in the DDR and other countries.

Brief descriptions are given also of certain species of lesser economic importance such as *L. mutabilis*, *L. polyphyllus*, *L. perennis*, *L. hirsutus*, *L. pilosus* and *L. varius*, and a key is provided for determining those species that have any agricultural interest.

1164 EDGERTON, C. W.
Sugarcane and its diseases.
Louisiana State University Press, Baton Rouge 1959 : $750 : Pp. x + 301 : 40 figs.

As explained in the foreword, this textbook is in the main a revision of lectures, reviews, abstracts, class material and published and unpublished results of research, which have been prepared and used by the author while teaching a course in the pathology of the crop at Louisiana State University over a period of more than 20 years. At a successfully elementary level, the first part provides suitable background knowledge for the subsequent consideration of sugar-cane diseases and their problems in part two, chapters on the history of the crop and its botany and physiology being followed by three on classification, breeding and varieties. In part two, detailed information is provided on pathogens, symptoms, methods of control and other aspects, including varietal susceptibility. The diseases are dealt with in ten chapters: fungal rots of the stalk; smuts; lesions and spots on the leaves caused by fungi; mildews; multiple bud and other malformations; bacterial diseases; root rot, including various root failures; various blemishes, injuries and minor diseases; parasitic flowering plants; and viruses. A list of selected references is provided, conveniently arranged according to chapter. Although, as might be expected, the diseases have been treated with the emphasis on Louisiana, much information is included on pathological problems in other countries. The book should therefore be found useful by those interested in the crop in other sugar-cane producing countries.

1165 COOLHAAS, C., DE FLUITER, H. J. & KOENIG, H. P.
Tropische und subtropische Weltwirtschaftspflanzen, ihre Geschichte, Kultur und volkswirtschaftliche Bedeutung. III. Teil : Genusspflanzen, 2. Band. Kaffee. (**Tropical and subtropical plants of world commerce, their history, cultivation and economic importance. Part III : Stimulant plants. Volume 2. Coffee**).
Ferdinand Enke Verlag, Stuttgart 1960 : 2nd Ed. : unbound DM 47, bound DM 51 : Pp. vii + 315 : 66 figs. : 54 tables.

Appearing 26 years after the publication of the first edition [V, p. 173], the second is a new work incorporating only a few passages from the earlier edition. In an attempt to deal with the wealth of information which has accumulated on this crop, three authors have cooperated in the production of this edition.

The first four sections, contributed by C. Coolhaas, provide: an historical survey of coffee drinking and the cultivation of *Coffea*; a biological description of the plant, including notes on species and varieties; information on the general conditions required for growth; and a full account of cultivation, this last section including a short chapter on the selection of suitable planting material. H. J. de Fluiter writes on diseases and pests, mentioning methods of control. Further sections concerned with the harvesting and preparation of coffee beans, the composition of coffee and the uses of various products of the coffee plant are provided by C. Coolhaas, and the concluding section on the economic importance of coffee is contributed by H. P. Koenig.

This book provides much information of use to those engaged in growing *Coffea* and in the preparation and selling of its products; the value of the book would however have been enhanced by the inclusion of a chapter on the genetics of *Coffea* and more details of breeding.

A separate bibliography follows each section and there is an adequate subject index in which some of the pests and diseases are entered under their English names. The diagrams are in the main clear and helpful and there are a number of photographs.

1166 SINGH, L. B.
The mango.
Leonard Hill Books Ltd., London 1960 : 84s. : Pp. xiii + 438 : 75 figs. : 21 tables : 54 plates.

Although the mango is as important in the tropics as the apple in temperate countries, no work dealing with it comprehensively has been available prior to publication of this volume. The monograph by S. R. Gangolly *et al.*, which was published in 1957 and is based largely on information gained from the scheme for varietal classification promoted by the Indian Council of Agricultural Research, has however done much towards filling this gap and should long serve as a chief work of reference, certainly in so far as India is concerned [cf. XXVIII, p. 413]. It is surprising that this monograph is not listed in the bibliography included in the present volume. With a more ambitious aim, this new book on the mango is a survey of information on all aspects of its botany, cultivation and utilization, not only with regard to India, where the mango is most important, but also to other countries. An up-to-date evaluation of the position in research on the mango is provided in the course of the treatise and future lines of work considered to be necessary are indicated. As Director of the Horticultural Research Institute, Saharanpur, Uttar Pradesh, the author is well equipped for collating and assessing all the available knowledge. An opening chapter on the history, origin, nomenclature and distribution of the crop is followed by one on the botany of *Mangifera indica* and other species and on rootstocks and by a third on cytogenetics and breeding. In chapter 7, problems of varietal classification and the systems of classification so far used are discussed. A system based on 11 characters of the fruit, leaf and inflorescence has been found satisfactory. A schedule for variety description is given, which incorporates these and other characters and which has been applied in making the descriptions included of 101 varieties grown in India and elsewhere. The confusion in the nomenclature of varieties has been reduced by recognition of many synonyms. Other chapters deal with: fruit-bud differentiation and periodicity in cropping; climate; soil; propagation; planting and care; irrigation; nutrition; diseases and their control; insects, mites and other pests; marketing; and utilization. The last-mentioned chapter is concerned with chemical composition and food value, principles underlying different methods of preservation, equipment and, last but not least, mango products and recipes. The work is well illustrated by drawings and photographs, with some exceptions. The index does not include varietal names. Since the varietal descriptions do not adhere to an alphabetical order, inclusion of an index to varieties might have been considered by some readers to be more useful than the table, sandwiched between the bibliography and index, giving conversion factors of weights and measures.

1167 COLLINS, J. L.
The pineapple.
Leonard Hill Books Ltd., London 1960 : 60s. : Pp. xvii + 294 : 31 figs. : 47 tables : 39 plates.

The astonishment and delight of European people on encountering the pineapple for the first time are reflected in many of the records left by early explorers and colonists of the American continent. Transported to Europe, the pineapple became the most fashionable of fruits and such a demand was created, we are told, that the same fruits would be rented or loaned to grace the table at several dinner parties in succession. Pineapple growing became the hobby of gardeners on large estates in England and in continental Europe and many new varieties were developed. Yet, despite its rapid dissemination during the years following its discovery and its establishment in tropical countries throughout the world, it is only in the last half century that the pineapple has become an important agricultural crop, and this only in relatively few geographical areas.

A survey of the varieties grown in the ten principal production areas shows the industry to be largely dominated by a single variety, Cayenne. It comes as no surprise therefore that much of the breeding work today is centred on this variety. A long chapter (the longest in the book) devoted to cytology, genetics and breeding is based mainly on work carried on in Hawaii where Dr. Collins worked for many years. The results obtained there from intergeneric and interspecific crosses, many of them concerned with the improvement of Cayenne or the development of new varieties from it, are fully discussed, and special attention is given to mutations and to polyploids. Cultural methods used in pineapple production on various scales and in different countries and climates are discussed, and diseases, abnormalities and pests are described and control measures given where known. A final section is devoted to fruit preservation and by-products.

This comprehensive and very readable book contains, as well as numerous line drawings, a large number of half-tone plates, some of which are very good indeed, and at least one of which would have made a more satisfactory frontispiece than the rather poor colour photograph actually chosen. But this is a minor criticism of an otherwise admirable book which is completed by a bibliography of nearly two hundred references, separate author and subject indexes, and also a table of conversion factors for weights and measures.

1168 VEDEL, H. & LANGE, J.
Trees and bushes in wood and hedgerow.
Methuen & Co. Ltd., London 1960 : 16s. : Pp. 224 : figs. : plates.

A key to the identification of trees and shrubs which relies almost entirely on leaf or inflorescence characters and in which graphic descriptions are as plentiful as verbal, is the most striking feature of this very practical handbook. With the aid of this key the common trees and shrubs native to England, together with a considerable number of introduced species, may be easily identified and checked by about 100 superb coloured plates. These plates illustrate both habit and detail and include associated insects in some cases, as well as the use to which the species is put. Specific descriptions follow which include notes on nomenclature, habitat and distribution. It is in this section of the book that the defects in the adaptation from the original Danish become apparent, as certain species, e.g. *Castanea sativa*, presumably not included in the original, have been added, but are not present in the key. In other cases there are notable omissions, e.g. the English elm, *Ulmus procera*, and *Quercus ilex*, a tree grown extensively in some parts of Britain; these receive no mention. *Ulmus laevis* and *Quercus borealis*, which are very rarely encountered, are, however, included and illustrated, and *Daphne mezereum* likewise, although the more frequently encountered *D. laureola* is only mentioned and is absent from the key.

Geographical races are distinguished in some instances, but here again, in *Pinus sylvestris* for example, var. *scotica* receives no mention, only the north Scandinavian and central European races being referred to.

The English names given to some species have an artificial ring in some cases, particularly where the species is, in fact, barely known in this country. The Welsh and Irish names are liable to be misspelled.

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